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Abstract

This study examines the effect of financial development on tax revenue mobilization in developing countries. Our empirical analysis uses the aggregate financial index that comprises the banking system's depth (size and activity), access, and efficiency of financial institutions and financial markets. Using panel data from developing countries over the period 1995-2017, our findings suggest that more developed financial sectors positively and significantly influence the government's ability to raise tax revenue. More interestingly, we find that this favorable effect is sensitive to developing countries characteristics, namely the level of economic development, the degree of financial openness and the stance of fiscal policies. When we more precisely look at the effects of disaggregated financial development components on tax revenues mobilization, we find that the estimated coefficients on the sub-components of financial development are statistically significant at least at 5 % of significance, except for the financial market's efficiency. The results denote that tax revenue in developing countries depends on financial institutions and financial markets. Finally, our results show that financial development contributes positively to tax revenue mobilization excluding resources.

Keywords

Financial development, Non-resource tax revenue, Domestic Tax revenue, Economic growth

JEL Codes

C23, E62, G21, H20, O11

1 Introduction

The concept of financial development (FD) extends back to the seminal work of [Schumpeter \(1961\)](#), [McKinnon \(1973\)](#), and [Shaw \(1973\)](#). The definition of this concept has emerged considerably over time. For example, Shaw (1973) defined financial development broadly as "the accumulation of financial assets at a faster rate than the accumulation of non-financial assets." Next, [Levine \(2005\)](#) expands on this definition: " *Financial development is achieved when financial instruments, markets, and financial intermediaries reduce, but not necessarily eliminate, the costs of obtaining information, the costs of enforcing contracts, and the costs of transactions, and consequently do a better job of providing five financial functions.*" *Levine's five main functions that require financial development are: (i) producing ex-ante information on projects and promoting optimal allocation of resources, (ii) monitoring investments and controlling enterprises, (iii) facilitating financial transactions, risk hedging, asset diversification, and risk pooling, (iv) ensuring the mobilization of savings, and (v) facilitating the exchange of goods and services.* In this paper, we define our financial development following the World Bank ([Washington 2020](#)). Financial development is: "conceptually, a process of reducing the costs of acquiring information, enforcing contracts, and making transactions. "The literature on financial development is still developing, with new definitions, determinants, and measurement procedures being suggested. The factors that facilitate, restrict or reverse financial development are documented in [Huang \(2010; 2011\)](#); [Girma and Shortland \(2008\)](#); [Herger, Hodler, and Lobsiger \(2008\)](#); [Yang \(2011\)](#); [Roe and Siegel \(2011\)](#). These include institutional quality, macro-economic policies, geographic and cultural characteristics. The measurement of financial development remains an important issue for empirical studies. Different authors use various sources and analytical methodologies to estimate the value of financial development from developing countries ([IMF; World Bank; European Statistics; Svirydzenka, 2016; Levine, 2005; Levine and Zervos, 1998](#)).

Financial development constitutes a potential source of tax revenue mobilization for developing countries ([Bohn, 1990; Gordon and Li, 2009](#)). Tax revenue mobilization is essential for three reasons ([IMF, 2018](#)). First, developing countries need to mobilize resources for investments to achieve sustainable development objectives. Second, with increasing debt levels, tax revenue

mobilization is a strategy for fiscal consolidation. The third reason is that a substantial tax collection capacity helps to strengthen institutions and increase state capacity. According to the [IMF \(2017\)](#), developing countries remain the region with the lowest tax revenues as a percentage of GDP in the world. However, public expenditure needs are much higher in these countries. The Consensus resulting from the 2002 Monterrey Conference on Financing for Development identified external and domestic resources as sources of financing for economies. Years after this International Conference, developing countries are still struggling to ensure effective mobilization of domestic resources. In August 2015, the International Conference on Financing for Development and Sustainable Development held in Addis Ababa stressed that developing countries' development financing strategies were based on robust domestic resource mobilization. However, it is official development aid, multilateral or bilateral debt, and foreign direct investment that finances the levers of structural transformation. The existing infrastructure in these countries (roads, telecommunications, and port facilities) is so poor that it seriously limits economic growth and the education and health of their workers. The resulting fiscal problems seriously hamper economic growth in these countries. To improve economic growth and reduce dependence on official development assistance, developing countries must close their infrastructure gaps in many areas such as education, health, electricity, roads, ports, motorways...etc. ([Calderón and Servén, 2004](#), [Arezki and Sy, 2016](#); [Esfahani and Ramírez, 2003](#)). Domestic resource mobilization could help these countries address these development challenges. There is voluminous literature on the determinants of tax revenue mobilization. However, few studies have shed light on the link between financial development and tax revenue in developing countries: examples include ([Bohn, 1990](#); [Tavares and Valkanov, 2001](#); [Gordon and Li, 2009](#); [Ardagna, 2009](#); [Gilbert and Ilievski, 2016](#)) investigate the effects of the financial system on either banking or non-banking activities. Indeed, the scope of these papers encounters several limitations. First, different measures of financial development are generally highly correlated and are frequently subject to measurement error. Second, previous studies tend to examine a single indicator, such as bank credit or stock market capitalization, as a proxy for FD, which leads to failure in capturing the complex multidimensional nature of the FD process. In this study, we use a system of FD indicators proposed by [Svirydzenka \(2016\)](#). The analysis of how financial development facilitates tax revenue mobilization is an essential issue in developing countries. Thus, developing countries' financial

sector appears as a necessity in economic development because it acts on economic growth through capital accumulation and improvement of productivity. Therefore, we ask the following question: What is the impact of financial sector development on tax revenue mobilization in developing countries? We contribute to this literature by assessing the macroeconomic impact of financial development in tax revenue mobilization in developing countries. Indeed, the relation between financial development and tax revenue mobilization is essential for policymakers. Policymakers want to know policies affect tax revenue (mobilization) as well as how they affect growth.¹ Understanding this relationship will allow policymakers to assess whether financial development will improve tax revenue mobilization. Our investigation is also distinguished using the new financial development database recently compiled by [Sviryzdenka \(2016\)](#).²

To explore the relationship between financial development and tax revenue, we use the system-GMM estimator of [Blundell and Bond \(1998\)](#) that properly tackles endogeneity. Our analysis conducted on a broad panel of 46 developing countries over the period 1995-2017 reveals the following:

- (i) We confirm that financial development increases tax revenue mobilization.
- (ii) The strength of our finding is secured by a rich robustness analysis that includes an alternative tax revenue measure, additional control variables, and traditional measures of financial development.

First, we investigate the robustness of this finding concerning an important source of debate, namely the measure of tax revenue. Moving away from ICTD's non-resource tax revenue measure (used in our baseline analysis), which are calculated as total tax revenue (excluding grants and social contributions) minus revenues from resource taxes (% of GDP) following [Brun, Chambas, and Mansour \(2015\)](#), we use domestic tax revenue (as a % of GDP) as an alternative measure of tax revenue. Estimations with this alternative measure confirm our finding that financial development increases tax revenue mobilization.

¹ Although recent studies have established a strong link between financial sector development and economic growth, more minor studies have focused on the relationship between financial sector development and tax revenue mobilization.

² The World Economic Forum publishes a Financial Development Index annually. The index database provides nine (09) indices for over 180 countries with annual frequency from 1980.

Second, accounting for additional control variables confirms the strongly significant and positive effect of financial development on tax revenue mobilization.

Third, we use five traditional financial development measures as an alternative measure of financial development, namely liquid liabilities, central bank assets, deposits money bank assets, private credit by money banks, and private credit by money banks and other financial institutions that have been used in the literature by [King and Levine \(1993\)](#), [Levine and Zervos \(1998\)](#), [Levine, Loayza, and Beck \(2000b\)](#) among others. Estimations with these alternative measures confirm our finding that financial development increases tax revenue mobilization when financial development is measured by the liquid liabilities, the deposits money bank assets, the private credit by money banks, or the private credit by money banks and other financial institutions.

Fourth, and for the finish we assess the effect of components of financial development on tax revenue mobilization. Financial markets, financial institutions, financial markets depth, financial institutions' depth, financial markets access, financial institutions access, and the financial institutions' efficiency positively and significantly influence the government's ability to raise tax revenue, except for the financial institutions market's efficiency.

(iii) Finally, we explore possible heterogeneities by disaggregating the sample based on various economic and structural characteristics, namely the level of economic development, the degree of financial openness, and the stance of fiscal policies. We reveal that financial development exerts a more pronounced effect on domestic tax revenue mobilization in “low-income” compared to “high-income” developing countries. Likewise, financial development fosters tax revenue both in “high” and “low” financial openness regimes, but the effect is more pronounced in the former regime. Regarding the fiscal stance, we find that financial development increases tax collection only when the debt stock is relatively low, underlining the difficulty of raising additional taxes when debt is large.

The remainder of the paper is organized as follows. Section 2 reviews the previous literature and section 3 exposes the model. Section 4 focuses on the empirical analysis, and section 5 discusses our empirical results. Section 6 analyzes their robustness, and section 7 explores heterogeneities in

the effect of financial development on tax revenue related with economic, and structural factors. Section 8 concludes.

2 Financial development and tax revenue mobilization: literature review

This section discusses whether financial development is essential for fiscal policy. Conceptually, I review ways in which the services provided by the financial system may affect tax revenue collection. Those countries with financial systems that are better at performing will mobilize more tax revenues than those with less developed financial systems. So far, little evidence exists of the effects of financial development on tax revenue in developing countries. Financial development plays a significant role in the mobilization of tax revenue. Broadly speaking, financial development can have a direct and indirect effect on tax revenue.

2.1 Financial development on tax revenue mobilization: direct channel

The direct effect stems from the state's ability to tax the financial sector. For instance, [Demirgüç-Kunt and Huizinga \(2001\)](#) show that the financial sector represents significant value-added, employment, and potential tax revenues. In theory, the financial system provides five critical services for economic growth (see [Levine \(2005\)](#)). We argue that these services offered by financial systems could improve the tax administration's performance in collecting tax revenues. To begin with, better access to financial services may facilitate the tax recovery and compliance by taxpayers, i.e., the financial system aids in the tracking and recovery of taxes. Banks, insurance companies, and other financial institutions provide liquidity to the companies and consumers by providing various payment systems essential for their money transactions (see [Elliott 2010](#)). For example, a country with well-developed, transparent, and efficient financial institutions will be used by companies and taxpayers to carry out their transactions. In turn, tax collecting authorities may obtain precious information from those financial institutions, such as the income and assets of taxpayers.

In contrast, for underdevelopment financial institutions, the size of the informal economy increases and makes the acquisition of tax information more accurate. In the same vein, [Gilbert and Ilievski \(2016\)](#) postulate that Tax-to-GDP ratios increase when bank deposits increase, meaning that taxes

on GDP increase for a given value of bank deposits. Bank deposits act here as a source of information for governments. More households use financial instruments to spend their income; its spending is observed by the government and taxed. In general, the efficient perception of people's income taxes is sometimes very complicated even in advanced economies, which have a high level of financial development, and seemingly impossible if income is frequently received and spent in cash. The situation would worsen in developing countries with an underutilized banking system, where most tax revenues come from local and foreign companies. Similarly, governments could tax bank deposits to increase tax revenues. Another strand of research that has been pursued is the role of the lack of state capacity in developing countries (Besley and Persson 2009, 2010; 2013).³ Gordon and Li (2009) stress that governments in developing countries are trying to collect more taxes from businesses but are not succeeding. Their tax revenues are limited by their incapacity to collect them. After accounting for state capacity variables, firms in countries with a more developed financial sector report a larger share of their sales to the tax authority. In their further study, Gordon and Li (2009) assume that state capacity is given and that there is asymmetric information in credit markets, particularly within developing countries. If the state capacity is enforced, they analytically show that with a more developed financial sector, which offers lower agency/monitoring costs, the government of a developing country will increase its optimal tax-auditing probability on operating establishments, which in turn generates a significantly higher ratio of tax revenue to GDP in developing countries. The above theoretical studies of the positive relationship between finance and tax revenue also accord with previous empirical studies, which show a positive relationship. For example, Bohn (1990) emphasizes a positive relationship between financial development and tax revenue. Taha, Colombage, and Maslyuk (2010) find a significant relationship between direct tax revenues and financial activities. In a similar vein, the development of the bonds and stocks market plays a crucial role in revenue generation. Empirical work by Taha et al. (2013) concluding that the development of the financial system positively influences direct tax revenue in Malaysia.

³ These studies pointed out that developing countries are limited by two complementary aspects of state capacity: (i) fiscal capacity and (ii) legal capacity.

2.2 Financial development on tax revenue mobilization: indirect channels

To the extent that financial development impacts the state of the economy, it will also have an indirect effect on domestic tax mobilization, although alternative macroeconomic channels could be important. These factors include international trade, the underground economy, tax evasion activities, and corruption. According to [Beck \(2002\)](#), [Svaleryd and Vlachos \(2002\)](#), [Kim, Lin, and Suen \(2010\)](#) and [Sare and al. \(2018\)](#) find that financial development facilitates international trade. [Dabla-Norris, Gradstein, and Inchauste \(2008\)](#), [Beck, Lin, and Ma, \(2014\)](#), and [Guo and Hung, \(2020\)](#) find that financial development reduces a company's degree of tax evasion. In turn, [Capasso and Jappelli \(2013\)](#) show that financial development (a reduction in the cost of external finance) can reduce tax evasion and the size of the underground economy. We argue that economic growth is the main indirect channel through which financial development could affect domestic tax revenue mobilization. Financial systems impact investment decisions on productivity enhancement activities through two mechanisms: (i) by assessing potential investors and investing in the most successful ones, (ii): they may also provide research, assessment, and supervisory support more efficiently and cost-effectively than individual investors or individuals, they are equally able to mobilize and provide the appropriate financing to investors rather than to individuals (see [King and Levine \(1993\)](#)). In sum, the assessment and screening of investors reduce the cost of investment in improving productivity and stimulates economic growth. As a result, economic growth would increase considerably, and the country's government could collect higher tax revenues. There is a large literature ([King and Levine, 1993](#), [Levine, 1996](#), [Levine and Zervos, 1998](#), [R. Rajan and Zingales, 1996](#), [Levine, Loayza, and Beck, 2000](#), [Levine 2001, 2005](#), [Ang and McKibbin \(2007\)](#), [Greenwood, Sanchez, and Wang \(2013\)](#)) provided empirical evidence of a positive impact of the financial development on the economic growth. Likewise, a developed financial system may facilitate exchanges of goods and services (trade transactions), contributing to boosting the competitiveness of companies on the international market. Consequently, this will result in increasing exports and imports, and the country concerned could be able to generate higher tax revenues. Specifically, the positive effect of international trade on tax revenues is expressed through revenues generated from taxes on international trade (so-called gate revenues) and domestic tax revenues. Moreover, financial development may contribute to reducing a company's

degree of tax evasion. For example, larger companies and societies owned by foreign investors and other societies whose financial statements are reviewed by external auditors are less likely to escape taxes. Individuals and companies escaping taxes or irregularly operating tend to hide their income. Indeed, access to external credits is very costly for companies having greater tax avoidance practices. Financial development encourages more transparency of companies that depend increasingly on external financing. Thus, developing countries being the most affected by tax evasion, with a certain high level of financial development, may reduce the tax revenue lost due to tax evasion. Finally, financial development is a potential disincentive to the spread of the informal economy.⁴ According to [Capasso and Jappelli \(2013\)](#), when companies or individuals work informally, their ability to report income and assets is lower and the cost of credit higher. Thus, as financial markets become more developed, more efficient intermediaries penetrate the market, and the cost of credit decreases, increasing the cost of the opportunity cost of continuing underground exploitation.⁵ In Brief, financial development leads to the formalization of firms or individuals, i.e., it pushes firms to reveal information about their income and assets to financial intermediaries and tax officials.

3 Model

Several papers have studied the structural factors of the economy (see [Lotz and Morss, 1970](#), [Chelliah, 1971](#), [Vito Tanzi et al., 1981](#), [Vito Tanzi, 1992](#), [Ghura, 1998](#), [Mahdavi, 2008](#), [Bird, Martinez-Vazquez, and Torgler, 2008](#), [Khattry and Rao, 2002](#), [Baunsgaard and Keen, 2010](#), [Crivelli and Gupta, 2014](#)) and the quality of institutions (see ([Gupta, 2007](#), [Bird, Martinez-Vazquez, and Torgler, 2008](#), [Dioda, 2012](#), [V. Tanzi and Davoodi, 2001](#))) as the main determinants of revenue mobilization in developing countries and none of them have analyzed the financial

⁴ Many factors explain the emergence and size of informal activities, such as high taxation, high social charges, heavy legislation, and labor costs, as factors that may push firms into informality. Among these factors, credit availability and its price have received little attention.

⁵ The starting point of this analysis is that the ability to reveal and report income reduces the frictions of information and the cost of credit ([Ellul et al., 2016](#)).

development as a potential determinant of tax revenue. This paper aims to fill the gap in previous literature by focusing on the impact of financial development on tax revenue mobilization.

Following numerous studies on the determinants of the performance of public revenues, especially in developing countries (see [Baunsgaard and Keen, 2010](#), [Crivelli and Gupta, 2014](#), [Gnangnon and Brun, 2018](#)), we use the dynamic panel model:

$$Y_{i,t} = \theta_1 Y_{i,t-1} + \beta_1 FD_{i,t} + X_{i,t} \beta_2 + \alpha_i + \mu_t + \varepsilon_{i,t} \quad (1)$$

Where $Y_{i,t}$ represents the mobilization of non-resource tax revenue from country i in period t . θ_1 is the coefficient of lagged non-resource tax revenue mobilization (tax revenue/ GDP). FD represents the level of financial development. We are mainly interested in β_1 , which is the coefficient of FD . X is the vector of control variables; these include GDP growth, trade openness, natural resource rents, the share of agriculture, polity2. α_{it} and μ_t are the country and time fixed effects, and ε_{it} an error term. The time coverage extends from 1995 to 2017.

The financial development index measures the level of financial development measured by five banking sector performance indicators and size. Financial development summarizes depth (market size and liquidity), access (the ability of individuals and companies to access financial services), and efficiency (the power of institutions to provide financial assistance at low cost and with sustainable incomes and the level of activity in capital markets). Drawing from the literature on the determinants of tax revenue ([Lotz and Morss, 1967, 1970](#), [Chelliah 1971](#), [Chelliah, Baas, and Kelly, 1975](#), [Vito Tanzi et al., 1981](#), [Vito Tanzi, 1992](#), [Ghura, 1998](#), [Khattry and Rao, 2002](#); [Gupta, 2007](#), [Bird, Martinez-Vazquez, and Torgler, 2008](#), [Baunsgaard and Keen, 2010](#), [Brun, Chambas, and Mansour, 2015](#), [Dioda, 2012](#)) we retain several key factors, including structural factors, that influence countries' tax revenue ⁶, that is:

⁶ Empirical findings show that Gdp growth, international trade, natural resource rents, agriculture share, inflation, etc., are some of the primary determinants of tax revenue. Interestingly, there are currently papers in the literature on the issue point out institutions and good governance as the most critical factors which affect tax revenue in DCs (see [Aaskoven \(2018\)](#)) ⁵.

- (i) The Growth rate of gross domestic product (Gdp-growth) controls the economic cycle and monetary conditions. This variable is assumed to have a positive effect on tax revenue. The growth rate of gross domestic product (Gdp_growth) controls the economic cycle and monetary conditions. This variable is assumed to have a positive effect on non-resource tax revenue.
- (ii) The degree of trade openness (trade openness) measured by the share of exports and imports should also impact tax revenue, but its expected sign is controversial. The more open a country is to the outside world, the more a positive effect of trade openness on tax revenue can be expected. Trade openness might have a positive sign because the increase in trade volume increases economic growth and increases tax revenue. For example, [Thomas and Trevino \(2013\)](#) observe a positive effect of trade openness on non-resource tax revenue. On the other hand, trade openness leads to at least tariff liberalization, which could be associated with lower tax revenue. The empirical literature on the impact of trade openness has provided evidence that trade openness is negatively related to total tax revenue and tax revenue from international trade ([Khattry and Rao, 2002](#)).
- (iii) Natural resource rents in the percentage of GDP (natural rents)⁷. The effect of natural resources on tax revenue is ambiguous. Indeed, on the one hand, a resource-rich country can generate a sizeable taxable surplus ([Gupta 2007](#)), while on the other hand, natural resources might reduce the governments' incentives for collecting taxes ([Lim 1988; Martinez-Vazquez 2001](#)).
- (iv) The share of agriculture in the GDP (Agriculture/GDP) measures the value-added in the agricultural sector as a proportion of total value-added. We expect agriculture to harm tax revenue considering the difficulty of taxing the farm sector ([Khattry and Rao, 2002, Baunsgaard and Keen, 2010, Brun, Chambas, and Mansour, 2015](#)).

⁷ Natural resource measure is the ratio of resource rents to GDP. These rents, which include rents from energy, minerals, and forestry.

- (v) Finally, we also control for Polity2⁸. This variable represents the quality of governance which measures the degree of democracy in a country. This variable is also expected to have a positive impact on tax revenue (Gupta 2007).

A significant concern when estimating equation (1) is the potential endogeneity. We have to solve three main problems to estimate equation (1) consistently. First, the error term incorporates unobserved country heterogeneities λ_i , inducing a bias of the omitted variables if correlated with the other explanatory variables.

$$E[(\lambda_i)(X_{i,t}) \neq 0] \quad (2)$$

$$\text{où } \mu_{i,t} = \lambda_i + \varepsilon_{i,t} \text{ et } \varepsilon_{i,t} \text{ est i. i. d (0,1)}$$

Second, the financial development influences tax revenue performance; it is also possible that the level of taxes (and hence tax revenue) could affect financial institutions and, therefore, the depth of financial development (see (Colombo and Caldeira, 2018; and Schandlbauer, 2017)). For example, an increase in tax revenue provides more public expenditure, which generally contributes to improving the state of infrastructure, leading to a better environment for developing the financial sector in the economy. Consequently, there is a causality bias due to the correlation between the error term and financial development variable:

$$E[(\mu_{i,t})(X_{i,t})] \neq 0 \quad (3)$$

Third, this equation (1) could generate a dynamic endogeneity bias concerns because of the presence of the lagged value of the tax revenue/GDP variable among the explanatory variables; it can be correlated with the error term:

⁸ The polity2 score corresponds to the difference between the democracy and the autocracy scores. It measures the competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraint on the executive.

$$E[(Y_{i,t} - 1)(\mu_{i,t})] \neq 0 \quad (4)$$

Linear dynamic panel models, such as Eq. (1), contain unobserved panel effects that can be fixed or random (see (Arellano and Bond, 1991)). By construction, the unobserved panel-level effects are correlated with the lag(s) of the dependent variable, making most standard estimation approaches inconsistent (see (Arellano and Bond, 1991)). Indeed, as Baltagi (2008) explained, standard estimators, such as the pooled ordinary least squares estimator, the fixed effects model, and the random-effects model, are inconsistent due to these problems cited above. Given the need to solve unobserved country heterogeneity, causality bias, and dynamic endogeneity bias, estimating this equation by a fixed-effects model would lead our results to suffer from Nickell's bias (Nickell, 1980) severe given the short duration of our data. The dynamic panel GMM estimators developed by Arellano and Bond (1991) and improved by Arellano and Bover (1995) and then by Blundell and Bond (1998) develop a method for estimating the generalized method of moments (GMM), which gives consistent parameter estimates for models of this type. We evaluate our dynamic panel model using the generalized moment method (GMM) estimator. Two specific econometric methods were used: Arellano and Bond (1991) generalized first difference moment method (GMM in difference) and Blundell and Bond (1998) generalized system moment method (GMM System). The GMM dynamic panel estimator is suitable for estimating our dynamic equation in which a one-year delay of the dependent variable is included as an explanatory variable. These two methods make it possible to control the heterogeneity of countries and address the problem of endogeneity of variables, which may (necessarily) arise when studying the relationship between financial development and tax mobilization (tax revenue mobilization). Indeed, the OLS estimate is biased (upwards) because of the correlation between the error term (which contains specific effects) and the delayed endogenous variable. In addition, the Within estimate is also lowered (downward) because the transformation results in a negative correlation between the error term and the delayed endogenous variable on small samples (Nickell, 1980). Thus, to correct Nickell's (1980) estimation bias, an instrumental variable method will be applied. The GMM estimator uses model-internal instruments (delayed values of variables suspected of endogeneity) to counter weak instruments and difficulties in processing several endogenous variables.

The GMM first-difference estimator consists of associating the first difference of the equation to be estimated to eliminate country-specific effects with each period and then to instrument our explanatory

variables of the first-difference equation by their level values lagged by one period. The GMM estimator in the [Blundell and Bond](#) system combines the first difference equations with the level equations in which their first differences instrument the variables.

To verify the validity of our estimate, three (03) tests were carried out so that the following assumptions could be confirmed:

- The AR (1) or m1 test of Arellano-Bond to test for the presence of 1st order autocorrelation (under the alternative hypothesis). In this test, the null hypothesis of absence of first-order serial correlation in the error terms must be rejected; the p-value of the test must be less than 0.10 (P-value 0.10)
- The AR (2) or m2 test of Arellano-Bond to test for the absence of second-order autocorrelation, (Under the null hypothesis). In this test, the null hypothesis of absence of second-order serial correlation in the error terms should not be rejected; the p-value of the test must be greater than 0.10 (p-value 0.10).
- Hansen's instrument exogeneity test for testing instrument exogeneity and the p-value of the test must be greater than 0.10 (p-value 0.10). We also apply [Roodman's](#) criterion by limiting the number of instruments to no more than the number of individuals. We use the `xtabond2` command of [Roodman \(2009\)](#) on Stata to make the estimates and assuming that tax revenue, the level of financial development, the Growth rate of gross domestic product, and trade openness are endogenous. Only natural resource rents, the share of agricultural value-added, and `polity2` are assumed to be weakly exogenous or exogenous.

4 Empirical analysis

4.1 Data and stylized facts

This sample period is determined by the availability of Financial Development (FD) Index data. Non-resource tax revenue data stem from the International Centre for Tax and Development (ICTD), and Tax revenue data stem from the IMF's tax revenue dataset. The data on the treatment variable is drawn from the Financial Development (FD) Index database of the financial structure and economic database. The data on control variables come from various sources, including The World Bank Group (World Development Indicators Worldwide Governance Indicators), The IMF World Economic Outlook

(WEO) data, GFI data, ICRG. The treatment variable in this study comprises the financial development index. Financial development data comes from financial structure and economic database. We use a global financial development index as a measure of financial development that allows us to assess specific characteristics of the level reached by the size, activity, and efficiency of financial intermediaries to test its impact on tax revenue mobilization. The following figure illustrates the level of financial development in countries around the world. As we can observe, the level of financial development is lower in Sub-Saharan Africa countries than in the rest of the world. We use a dynamic panel over the period 1995-2017. Our study covers a sample of 46 developing countries.

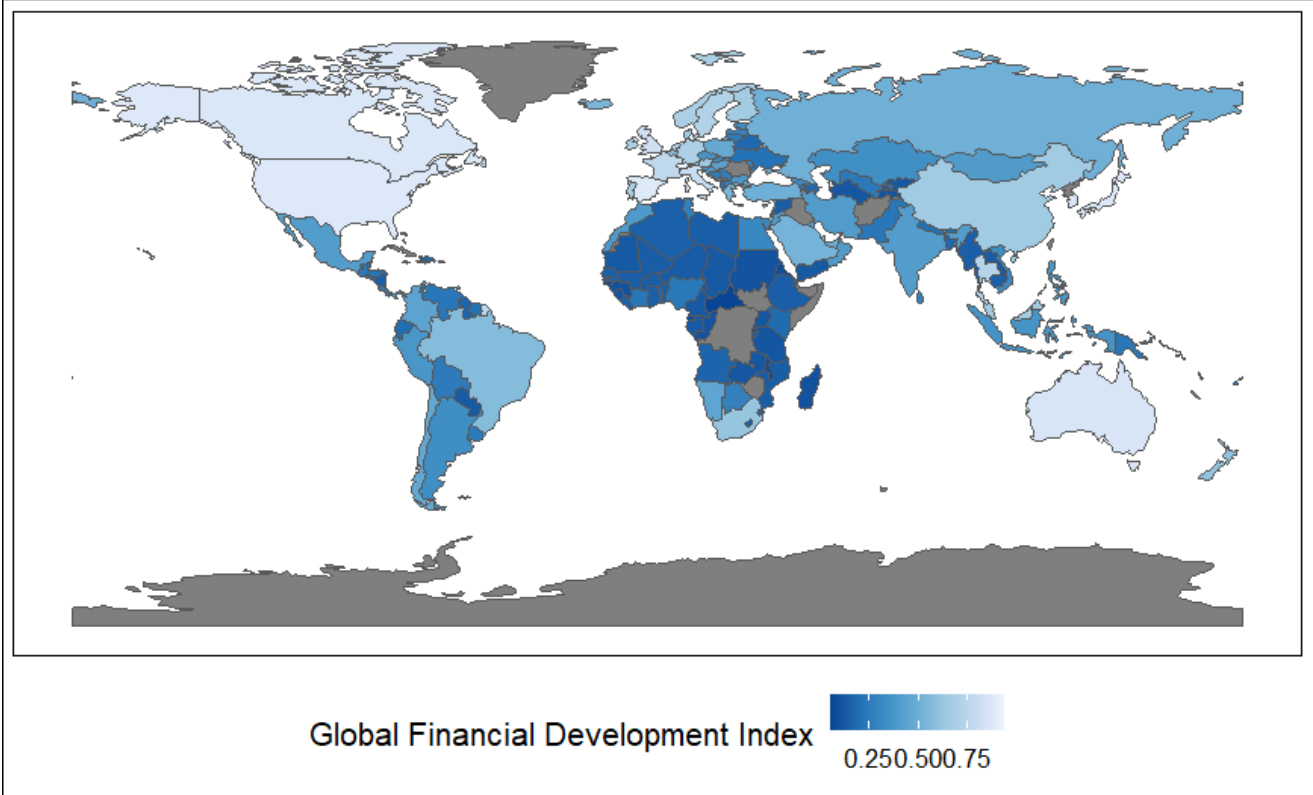


Figure 1: World map of the financial development index from 1995 to 2017

Table 1 contains the list of variables used in this paper and a brief description of the data. ⁹

Table 1: Descriptive statistics for main variables

Variable name	Obs	Mean	Std.Dev.	Min	Max
Tax revenue over GDP	1010	24.1954	10.0382	5.89	60.68
Non-Resource Tax Revenue over GDP	939	15.6737	6.3472	1.916	56.92
Financial Development Index	1058	0.2540	0.1434	0.0308	0.7299
GDP Growth	1057	4.4335	4.1270	-14.7586	34.4662
Trade Openness over GDP	1036	75.4580	33.8562	0.1674	220.407
Natural resource rents over GDP	1053	6.3340	8.3695	0.0227	55.8521
Inflation	1057	19.6206	168.061	-18.8992	4,800.53
Agriculture over GDP	1052	14.0530	10.1237	1.8283	57.2386
Polity2	1058	3.8449	5.5469	-10	10

Sources: World Bank, IMF

In Figures 2&3, we outline, for the first time, the relation between domestic tax revenue (respectively non-resources tax revenue) and various indices of financial development. The financial development global index is positively related to non-resource tax revenue. Also, Financial Institutions and Financial Markets seem to increase non-resource tax revenue. Financial institutions' depth, financial institutions' access, financial institutions' efficiency, and financial markets' depth positively affect non-resource tax revenue. In contrast, non-resource tax revenue is negatively related to financial market access and financial market efficiency.

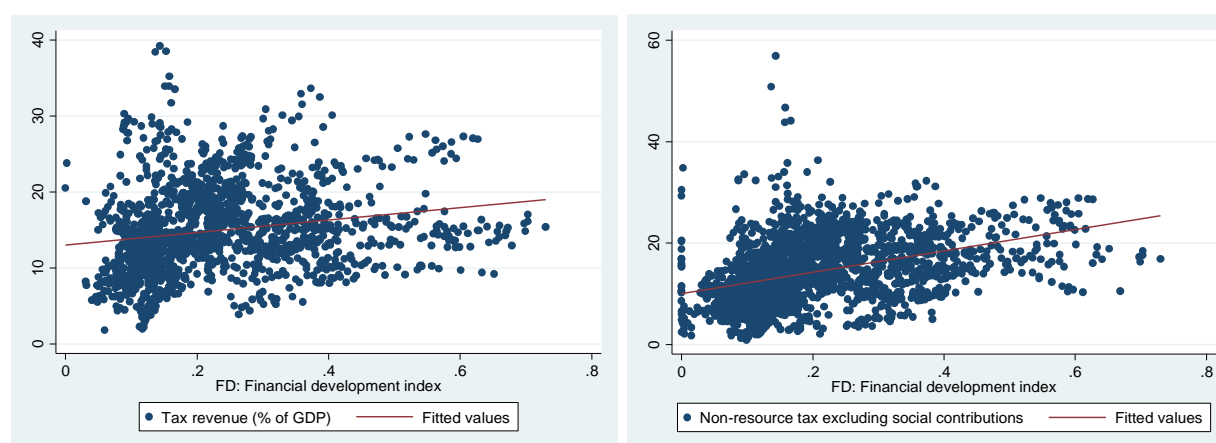


Figure 2: Domestic tax revenue (& non-resource tax excluding social contributions) and financial development index, financial institutions index and financial markets index.

⁹ Table C in the appendix presents the matrix of correlation of the variables studied.

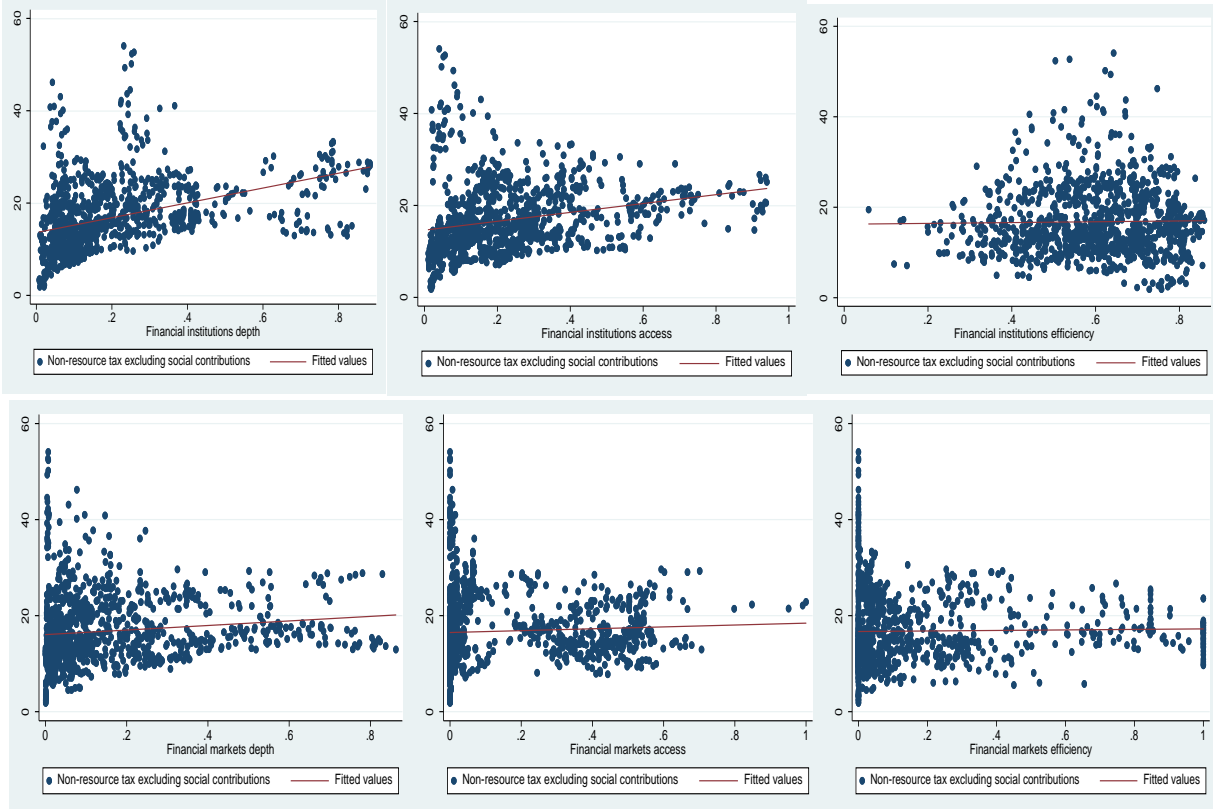


Figure 3: Non-resource tax revenue and financial institutions index sub-components and financial markets index sub-components.

The evolution of financial development highlights that the financial development index increases over the years in developing countries from 0.19 to 0.30 between 1995 to 2017. The financial development index is higher in the Middle East North Africa countries than in other regions worldwide.

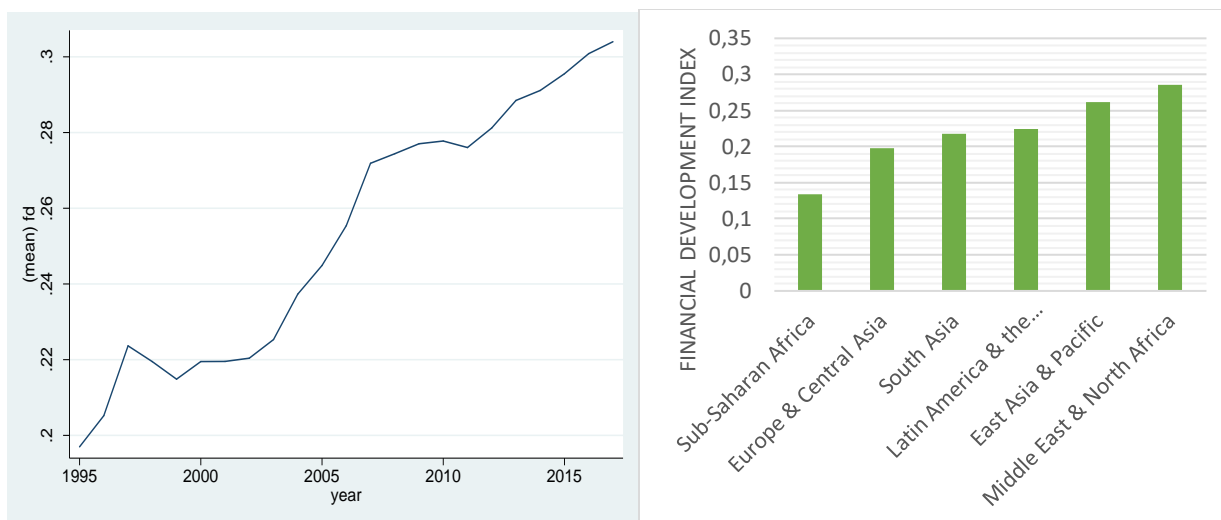


Figure 4: Evolution of financial development index over time and financial development by region from 1995 to 2017

5 Empirical results

This section presents the results of the financial development impact on non-resource tax revenue mobilization.

Table 2 presents the results for Specification 1, using the dynamic panel two-step system GMM estimations¹⁰. The statistical tests do not invalidate the econometric method: the null hypotheses of the Sargen/Hasen and AR (2) tests are accepted. Moreover, the positive coefficient of the lagged dependent variable highlights an inertia effect that legitimates the dynamic panel specification. Column [6] is the baseline model, including the lagged tax revenue variable, the financial development variable, real Gdp growth, trade openness, natural resource rents, agriculture value, and polity2. The lagged tax revenue variable's estimated coefficient is positive and statistically significant at a 1% level. This is a common finding in the literature indicating that non-resource tax revenue in one year is heavily influenced by non-resource tax revenue in the previous year, as

¹⁰ In this paper, our preferred estimator is the system-GMM. It has been highlighted that the lagged values of variables in level as it is done with the difference-GMM estimator are sometimes imperfect instruments for variables in first differences.

[Gnangnon and Brun \(2018\)](#) highlighted. We find that the coefficient of financial development is positive and statistically significant at the 1% level.

Financial development has a significant and positive effect on non-resource tax revenue. 1% increase in financial development is associated with a 0.290 percentage point increase in non-resource tax revenue. The more a country is characterized by a significant financial development (increase in the level of its financial development), the more there will be an increase in the flow of non-renewable non-resource tax revenue. The well-functioning financial sector (banking system, stock market, and bond market activity, etc.) of the developing countries enables the tax collection by the administration and the payment of taxes by taxpayers. Access to banking services facilitates at lower costs, which can help provide more instant liquidity and financing. Also, banks and financial institutions in facilitating financing provide different types of payment systems essential for monetary transactions; therefore, if a country has well-developed transparent and efficient financial institutions, businesses and taxpayers will use them to carry out their transactions. In turn, tax collecting authorities (tax collectors) can obtain valuable information from these financial institutions, such as the income and assets of taxpayers. On the other hand, in the case of underdeveloped financial institutions, the size of the informal economy increases and makes the acquisition of accurate tax information more difficult.

As for the control variables, Trade openness exerts a positive and significant impact on non-resource tax revenue. We observe that the level of natural resource rents is positively associated with non-resource tax revenue. These results are consistent with previous works ([Gupta 2007](#); [Tanzi 1992](#); [Ghura 1998](#)). We also note that non-resource tax revenue is negatively and significantly driven by high value-added agriculture (as % of GDP). The other control variables are not significant, including quality of governance (polity2) and real GDP growth.

Table 3 replaces the financial development variable in our specification by its one, two, and three-year(s) lag, respectively. The results suggest the positive impact of financial development on non-resource tax revenue. We first report the results for total financial development lagged one year, suggesting that an additional 1% of financial development is associated on average with a 0.279 percentage point increase in non-resource tax revenue by the country (column 1). The financial development coefficient remains significant and of a similar magnitude also when the financial

development variables are lagged by two and three periods. The other controls have all the typical signs.

Table 2. Baseline: The effect of Financial Development on non-resource tax revenue

Dependent variable: Log. non-resource over GDP	[1]	[2]	[3]	[4]	[5]	[6]
Lag (log. non-resource over GDP)	0.719*** (0.104)	0.701*** (0.100)	0.743*** (0.060)	0.712*** (0.065)	0.732*** (0.060)	0.731*** (0.059)
Financial Development Index	0.455*** (0.166)	0.420*** (0.134)	0.294*** (0.107)	0.310*** (0.095)	0.290*** (0.093)	0.290*** (0.095)
GDP growth		0.005*** (0.002)	0.005** (0.002)	0.002 (0.003)	0.001 (0.003)	0.001 (0.003)
Log. Trade Openness over GDP			0.052*** (0.026)	0.074* (0.041)	0.075* (0.044)	0.073* (0.038)
Log. Natural resource rents over GDP				0.011* (0.006)	0.013** (0.006)	0.013** (0.006)
Agriculture over GDP					-0.002* (0.001)	-0.003** (0.001)
Polity2						0.001 (0.002)
Constant	0.652*** (0.249)	0.681*** (0.243)	0.383** (0.165)	0.382** (0.150)	0.361* (0.203)	0.373* (0.201)
Observations	998	998	980	977	976	976
Countries	46	46	46	46	46	46
Instruments	13	19	22	22	23	24
Hansen	0.542	0.828	0.655	0.692	0.511	0.511
AR1	0.001	0.000	0.000	0.000	0.000	0.000
AR2	0.674	0.504	0.698	0.946	0.962	0.985

*Note: Robust Standard Errors are in parenthesis. The variables "GDP growth", "Financial Development Index" and "Log. Trade Openness over GDP" has been considered as endogenous across all model specifications. The variables "Log. Natural Rents", "Agriculture over GDP", "Polity2" have been considered as exogenous. Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01*

Table 3. Baseline: The Effect of Financial Development on tax revenue (using lag(s))

Dependent variable: Log. Non-resource over GDP	[1]	[2]	[3]	[4]
Lag (log. Non-resource over GDP)	0.731*** (0.059)	0.731*** (0.062)	0.762*** (0.064)	0.755*** (0.059)
Financial Development Index	0.290*** (0.095)			
Financial Development Index(t-1)		0.279*** (0.098)		
Financial Development Index(t-2)			0.275*** (0.104)	
Financial Development Index(t-3)				0.259*** (0.093)
GDP growth	0.001 (0.003)	0.002 (0.004)	0.005** (0.002)	0.005** (0.003)
Log. Trade Openness over GDP	0.073* (0.044)	0.076* (0.044)	0.046 (0.029)	0.052* (0.029)
Log. Natural Rents over GDP	0.013** (0.006)	0.011* (0.006)	0.006 (0.005)	0.007 (0.005)
Agriculture over GDP	-0.003** (0.001)	-0.003* (0.001)	-0.002* (0.001)	-0.003** (0.001)
Polity2	0.001 (0.002)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Constant	0.373* (0.201)	0.364* (0.217)	0.390** (0.180)	0.393** (0.162)
Observations	976	976	935	895
Countries	46	46	46	46
Sargan - Hasen test, p-value	0.629	0.750	0.504	0.700
AR (1) : p-value	0.000	0.000	0.000	0.000
AR (2) : p-value	0.985	0.956	0.767	0.186
Nb instruments	24	23	26	27

*Note: Robust Standard Errors are in parenthesis. The variables "GDP growth", "Financial Development Index" and "Log. Trade Openness over GDP" has been considered as endogenous across all model specifications. The variables "Log. Natural Rents", "Agriculture over GDP", "Polity2" have been considered as exogenous. Standard errors in parentheses *p < 0.10, **p < 0.05, ***p < 0.01*

6 Robustness checks

This section investigates the robustness of our findings that financial development significantly encourages non-resource tax revenue mobilization in developing countries.

6.1 An alternative measure of tax revenue

Following [Brun, Chambas, and Mansour \(2015\)](#), our principal domestic tax revenue measure is the non-resource tax revenue (as a % of GDP) from the International Centre for Tax and Development (ICTD), which are calculated as total tax revenue (excluding grants and social

contributions) minus revenues from resource taxes (% of GDP)—using of non-resource tax revenue as a dependent variable result in much greater homogeneity than total government revenue. We begin by taking a closer look at our dependent variable. We use the tax revenue ratio (as a % of GDP) from the International Centre for Tax and Development (ICTD), Government Revenue Dataset (GRD), and The IMF’s tax revenue dataset as an alternative measure of tax revenue. As we can observe, the coefficient associated with financial development is positive and enormously significant, suggesting that the increase in tax revenue does not change with the tax revenue measure. Finally, the estimated coefficient in domestic tax revenue in absolute value is 0.307 percentage point, a magnitude somewhat higher compared with our benchmark findings.

Table 4. Robustness: The effect of Financial Development on non-resource tax revenue (Alternative measure of tax revenue)

Dependent variable: Log. Domestic Tax revenue over GDP	[1]	[2]
Alternatives	Baseline	Alternative 1
	[1]	[2]
Lag (Log. Tax revenue)	0.731*** (0.059)	0.716*** (0.104)
Financial Development Index	0.290*** (0.095)	0.307** (0.152)
Constant	0.373* (0.201)	0.611* (0.356)
Observations/	976	945
Countries	46	46
Instruments	24	25
Hansen	0.629	0.613
AR1	0.000	0.004
AR2	0.985	0.881
Controls	Yes	Yes

*Note: Robust Standard Errors are in parenthesis. The variables “GDP growth”, “Financial Development Index” and “Log. Trade Openness over GDP” has been considered as endogenous across all model specifications. The variables “Log. Natural Rents”, “Log. Agriculture over GDP”, “Polity2” have been considered as exogenous. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$*

6.2 Testing for additional controls

We alternatively introduce additional covariates that may affect non-resource tax revenue mobilization. We add these additional covariates into the main specification to address the issue of omitted variables. (Column [1] is the baseline model. Column [2]-[8] include additional covariates). We control for the population density, financial (capital) openness index, migrants'

remittances (% of GDP), inflation, Foreign direct investment (% of GDP), aid (% of GDP), and the government debt (% of GDP).

In the second column [2], we control for population density-which measures the proportion of de people under 15 and those over 65. This variable is also expected to harm tax revenue. According to [Bahl \(2004\)](#), in countries with high population growth, the tax system may lag in its ability to attract new taxpayers. The coefficient of this variable is negative as expected and significant. We find that financial development still positively affects non-resource tax revenue. Adding the capital openness index in column [3] as a control variable, we find that this variable has a negative and significant effect on non-resource tax revenue. Financial development remains enormously substantial and positive.

In column [4], we add migrants' remittances as a control variable. This variable may increase recipient endowments and, therefore, their capacity to pay taxes. [Ebeke \(2010\)](#) reveals that remittances contribute significantly to both levels and stability of the government's tax revenue ratio in recipient countries. Table 5 shows a positive and significant effect of migrant remittances, while financial development remains firmly substantial and positive.

In column [5], we add the inflation rate-which captures the macroeconomic stability. This shows that the high level of inflation leads to low tax revenue. We expect this variable to reduce non-resource tax revenue. We observe that inflation negatively impacts non-resource tax revenue mobilization, but financial development remains enormously substantial and positive.

In column [6], we include the Foreign direct investment (% of GDP), which measures the capacity of a given country to attract foreign investors. This variable positively affects economic growth, and therefore it might have a positive effect on non-resource tax revenue. Even controlling for this variable, we observe that financial sector development still positively affects non-resource tax revenue.

In column [7], we control for aid¹¹ (% of GDP). This variable should also positively impact non-resource tax revenue, but that depends on the type of aid. Aid is also expected to harm non-resource tax revenue. [Clist and Morrissey \(2011\)](#) argued that aid flows reduce government revenue efforts, reducing the effectiveness of aid. We find that the coefficient relating to the aid is positive and

¹¹ The amount of official development assistance (grants plus concessional loans, measured in U.S. dollars) divided by Gross National Income

statistically significant. The most striking result is that aid positively impacts non-resource tax revenue mobilization. Let us remember that this is a topic where the sizeable existing literature provides no robust evidence. Following [Clements, Gupta, and Inchauste \(2004\)](#)'s research findings, countries that receive higher levels of foreign assistance will collect less domestic tax revenue, owing to weaker incentives to pursue politically costly local tax revenue mobilization. Similarly, [Yohou, Goujon, and Ouattara \(2016\)](#) show that aid directly reduces tax revenues, but it enhances tax performance for higher levels of government stability. Then, [Clist and Morrissey \(2011\)](#) present evidence that there was likely no consistent effect of aid on domestic tax revenue mobilization. [Brun, Chambas, and Guerineau \(2011\)](#) argued that the positive impact of aid was contingent on the quality of institutions in recipient countries. Lastly, [Clist \(2016\)](#) points to a modest but positive effect on foreign aid, generally on domestic tax revenue. Even controlling for this variable, we observe that financial development still positively affects non-resource tax revenue.

In the last column [8], we add the government debt, which may directly affect the conduct of fiscal policy by affecting government resources, and thus, potentially, on the tax revenue ratio.). We find that this variable has no significant effect on non-resource tax revenue. Financial development remains firmly substantial and positive.

Adding corruption in the last column [9] as a control for institutional factor, we find that this variable has no significant effect on non-resource tax revenue, but financial development remains enormously substantial and positive.

According to columns [2]-[9] in Table 5, the additional variables confirm the robustness of our baseline model. Whenever significant, their effect is consistent with what one may expect. Overall, accounting for other control variables proves the intensely substantial and positive effect of financial development on non-resource tax revenues mobilization.

Table 5 Robustness: Effects of Financial Sector Development on Non-resource tax revenue (additional controls)

Dependent variable: Log. Non-resource tax revenue over GDP	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Lag (log. Non-resource tax revenue)	0.731*** (0.059)	0.767*** (0.061)	0.744*** (0.061)	0.732*** (0.053)	0.730*** (0.064)	0.707*** (0.065)	0.768*** (0.048)	0.763*** (0.059)	0.789*** (0.096)
Financial Development Index	0.290*** (0.095)	0.271*** (0.103)	0.269*** (0.104)	0.263*** (0.092)	0.255*** (0.099)	0.336*** (0.102)	0.749*** (0.260)	0.294*** (0.107)	0.350*** (0.129)
GDP growth	0.001 (0.003)	0.005* (0.003)	0.004* (0.003)	0.003 (0.002)	0.006 (0.004)	0.004 (0.004)	0.006 (0.015)	0.005*** (0.002)	0.004 (0.004)
Log. Trade Openness over GDP	0.073* (0.044)	0.047* (0.028)	0.055* (0.031)	0.068 (0.044)	0.055 (0.049)	0.059*** (0.007)	0.038** (0.018)	0.064 (0.041)	0.043 (0.043)
Agriculture to GDP	-0.003** (0.001)	-0.001 (0.001)	-0.002* (0.001)	-0.004*** (0.001)	-0.004** (0.002)	-0.003* (0.002)	-0.004*** (0.001)	-0.004*** (0.001)	-0.002 (0.006)
Log. Natural resource rents over GDP	0.013** (0.006)	0.001 (0.005)	-0.004 (0.006)	0.000 (0.005)	-0.001 (0.006)	-0.003 (0.005)	-0.001 (0.006)	-0.004 (0.007)	-0.003 (0.002)
Polity2	0.001 (0.002)	0.001 (0.001)	0.002* (0.001)	0.000 (0.001)	0.001 (0.002)	-0.001 (0.002)	0.002 (0.005)	0.001 (0.002)	0.001 (0.002)
Log. Population Density		-0.020* (0.011)	-0.023** (0.010)	-0.031*** (0.010)	-0.035*** (0.012)	-0.005 (0.011)	0.031 (0.031)	-0.020 (0.013)	-0.021* (0.013)
Financial Openness Index			-0.018*** (0.014)	-0.020*** (0.006)	-0.019*** (0.005)	-0.039*** (0.015)	-0.051 (0.054)	-0.025*** (0.008)	-0.019 (0.013)
Log. Remittances				0.014* (0.008)	0.014 (0.010)	-0.146*** (0.053)	-0.043* (0.023)	0.008 (0.008)	0.006 (0.009)
Log. Inflation					-0.014*** (0.010)	-0.011* (0.007)	0.039* (0.021)	-0.016** (0.006)	-0.001 (0.040)
Log. Foreign direct investment over GDP						0.009* (0.005)	0.011* (0.005)	0.007 (0.006)	0.013* (0.007)
Log. Aid over GDP							0.767* (0.461)	0.874* (0.504)	0.784 (0.723)
Log. Government debt								0.011 (0.022)	0.037 (0.031)
Corruption									-0.003 (0.007)
Constant	0.373* (0.201)	0.443** (0.188)	0.488** (0.196)	0.529** (0.248)	0.638** (0.341)	0.602** (0.292)	0.470** (0.197)	0.376 (0.249)	0.252 (0.409)
Observations/	976	976	976	937	907	880	854	781	724
Countries	46	46	46	46	46	46	46	43	39
Instruments	24	30	29	28	25	26	34	34	27
Hansen	0.629	0.362	0.431	0.908	0.794	0.784	0.651	0.820	0.612
AR1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR2	0.985	0.716	0.751	0.626	0.600	0.118	0.106	0.119	0.213

Note: Robust Standard Errors are in parenthesis. The variables "GDP growth", "Financial Development Index" and "Log. Trade Openness over GDP" has been considered as endogenous across all model specifications. The variables "Log. Natural Rents", "Log. Agriculture over GDP", "Polity2" have been considered as exogenous. Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01

6.3 The sub-components of financial development

So far, we have focused on the aggregate financial development (FD) index. We now investigate the effects of disaggregated financial development components on non-resource tax revenue mobilization.



Figure 5. Financial Development Index -Overview ¹²

Financial development is defined as a combination of depth (size and liquidity of markets), access (the ability of individuals and companies to access financial services), and efficiency (ability of institutions to provide financial assistance at low cost and with sustainable revenues, and the level of activity of capital markets). Nine indices of the International Monetary Fund Financial Development Index (IMF-FDI) are used in this section to measure various dimensions of financial development and to consider the complex multidimensional nature of financial development other than just the financial depth of credit or the stock market (Svirydzenka 2016). Using these indices would provide an excellent understanding of the true relationships between the different dimensions of financial development and tax revenues, i.e., overall financial development and two sub-dimensions (including financial institutions and financial markets) and finally, the second level of dimensions that include financial depth, financial access, and financial efficiency. First, Financial institutions (FI) include banks, insurance companies, mutual funds, pension funds, and other non-bank financial institutions. Second, financial markets (FM) include mainly stock and

¹² Source: IMF staff, based on Čihák and al. (2012)

bond markets. Thirdly and to finish, within financial institutions (FI) and financial markets (FM), different dimensions of the financial system were measured: depth, access, and efficiency. The estimated coefficients on the sub-components of financial development are statistically significant, at least at 5 %, except for the efficiency of the financial markets. Note that the financing of the developing economies relies more on banking intermediation than on the stock market. For example, there is evidence that financial sectors are essentially bank-based (Gaies, Goutte, and Guesmi 2019, Andrianaivo and Yartey 2010, Senbet and Otchere 2006, Creane et al. 2006). The results denoting that domestic tax revenue in developing countries is dependent on financial institutions.

Finally, we pose the following question. Is it possible that one dimension of institutions—banking and nonbanking—as well as markets complements the other? The answer to this question may suggest that the three dimensions of institutions—banking and nonbanking—as well as markets may indeed reinforce each other's effectiveness, and if possible, such complementarity needs to be exploited. That is, the choice may not after all be between one or the other, but of capturing the multidimensional nature of the financial development process. Our central question is also related to a strand of the empirical literature since the 1970s which approximates financial development by the ratio of private credit to GDP, and to a lesser extent, by stock market capitalization, also as a ratio to GDP. We find that the coefficient of the interaction term of financial institutions depth and financial institutions efficiency, the coefficient of the interaction term of financial institutions access and financial institutions efficiency, and the coefficient of the interaction term of financial markets depth and financial markets access, the coefficient of the interaction term of financial markets depth and financial markets efficiency, and the coefficient of the interaction term of financial markets access and financial markets efficiency to be positive, which therefore points to a complementary relationship between financial institutions depth and financial institutions efficiency, financial institutions access and financial institutions efficiency, and financial markets depth and financial markets access, financial markets depth and financial markets efficiency, and financial markets access and financial markets efficiency.

Table 6. Robustness: The effect sub-components of financial development on non-resource tax revenue

Dependent variable: Log. Non resource tax revenue over GDP	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	
Lag (log. Non-resource tax revenue over GDP)	0.753*** (0.056)	0.739*** (0.069)	0.670*** (0.071)	0.743*** (0.057)	0.779*** (0.057)	0.759*** (0.065)	0.727*** (0.075)	0.990*** (0.056)	0.731*** (0.066)	0.743*** (0.148)	0.847*** (0.079)	0.857*** (0.117)	0.651*** (0.084)	0.732*** (0.061)	
Financial institutions	0.237*** (0.070)														
Financial markets		0.144** (0.071)													
Financial institutions depth			0.309*** (0.102)						0.220 (0.287)	-0.443 (0.309)					
Financial markets depth				0.132*** (0.045)								-0.051 (0.102)	-0.185 (0.133)		
Financial institutions access					0.371*** (0.0115)				0.133 (0.185)		-0.760* (0.398)				
Financial markets access						0.182*** (0.068)						-0.446** (0.182)		-0.173* (0.099)	
Financial institutions efficiency							0.212** (0.103)			-0.169* (0.091)	-0.222* (0.114)				
Financial markets efficiency								0.057 (0.062)						-0.121* (0.072)	-0.157* (0.094)
Financial institutions depth* Financial institutions access									-0.208 (0.826)						
Financial institutions depth* Financial institutions efficiency										0.928* (0.755)					
Financial institutions access * Financial institutions efficiency											1.288** (0.642)				
Financial markets depth * Financial markets access												0.992* (0.517)			
Financial markets depth * Financial markets efficiency													0.633* (0.347)		
Financial markets access * Financial markets efficiency														0.836** (0.349)	
Observations/ Countries	976/46	976/46	976/46	976/46	976/46	976/46	976/46	976/46	976/46	976/46	976/46	976/46	976/46	976/46	976/46
Instruments	30	19	19	25	30	30	24	19	23	19	21	14	20	25	
Hansen	0.831	0.206	0.704	0.826	0.529	0.788	0.417	0.455	0.424	0.341	0.922	0.998	0.910	0.840	
AR1	0.008	0.010	0.012	0.008	0.008	0.006	0.008	0.006	0.000	0.003	0.000	0.001	0.000	0.000	
AR2	0.948	0.868	0.716	0.823	0.947	0.943	0.987	0.828	0.868	0.486	0.497	0.581	0.845	0.875	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Note: Robust Standard Errors are in parenthesis. The variables "GDP growth", "Financial Development Index" and "Log. Trade Openness over GDP" has been considered as endogenous across all model specifications.

The variables "Log. Natural Rents", "Log. Agriculture over GDP", "Polity2" have been considered as exogenous.

²Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01

6.4 Alternative Financial development measures: Traditional measures of financial development

We now look at for each type of measure. Our empirical analysis uses five financial development measures: liquid liabilities, central bank assets, deposits money bank assets, private credit by money banks, and private credit by money banks and other financial institutions. First, liquid liabilities measure the size or financial depth used in the literature by [King and Levine \(1993\)](#). Second, central bank assets and deposit money bank assets count two financial sectors relative to GDP. These measures give evidence of the importance of the financial services performed by the two financial sectors close to the size of the economy. Finally, private credit by money banks and private credit by money banks and other financial institutions measure the activity of financial intermediaries in one of its primary functions: channeling savings to investors. Both measures isolate credit issued to the private sector instead of credit given to governments and public enterprises. Furthermore, they concentrate on credit issued by intermediaries other than the central bank. Also, they have been used in the literature, the first by [Levine and Zervos \(1998\)](#), and the second by [Levine, Loayza, and Beck \(2000a\)](#), and [Beck, Levine, and Loayza \(2000\)](#). Using these variables, we look both at the level and the magnitude effect. Regarding the level effect, in Table 6, we observe that the results mainly depend on the nature of the financial development indicator used. In particular, when the liquid liabilities, the central bank assets, the deposits money bank assets; the private credit by money banks, or the private credit by money banks and other financial institutions measure financial development, the empirical evidence supports the hypothesis that financial development significantly increases non-resource tax revenue. Table 6 shows a magnitude somewhat higher off the deposit's money banks assets, the private credit by money banks, or the private credit by money banks and other financial institutions effect than the other indicators regarding the magnitude effect. The impact of the central bank assets on non-resource tax revenue is relatively lower.

Table 8. Robustness: The effect of traditional measures of financial development on non-resource tax revenue

Dependent variable: Log. Non-resource tax revenue over GDP	[1]	[2]	[3]	[4]	[5]
Lag (log. Non-resource tax revenue over GDP)	0.726*** (0.070)	0.866*** (0.048)	0.686*** (0.076)	0.689*** (0.067)	0.686*** (0.061)
Log. Liquid liabilities to GDP (%)	0.113** (0.044)				
Log. Central bank assets to GDP (%)		0.004* (0.003)			
Log. Deposit money bank assets to GDP (%)			0.086*** (0.030)		
Log. Private credit by money banks to GDP				0.084*** (0.027)	
Log. Private credit by money banks and other financial institutions to GDP					0.093*** (0.104)
Constant	0.434** (0.170)	0.130 (0.179)	0.467** (0.229)	0.469** (0.230)	0.377* (0.209)
Observations/ Countries	973/46	950/46	974/46	974/46	973/46
Instruments	16	38	19	22	25
Hansen	0.448	0.394	0.763	0.817	0.967
AR1	0.000	0.000	0.000	0.000	0.000
AR2	0.622	0.322	0.506	0.671	0.741
Controls	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard Errors are in parenthesis. The variables "Log. GDP growth", "Financial Development Index" and "Log. Trade Openness over GDP" has been considered as endogenous across all model specifications. The variables "Log. Natural Rents", "Agriculture over GDP", "Polity2" have been considered as exogenous. ²Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01

7 Heterogeneity

One concern over the findings mentioned above is that these parameters may be heterogeneous across countries. In principle, the system GMM estimates impose homogeneity on all slope coefficients. A natural way to confront this problem is to investigate more homogeneous subsamples. This section turns to three subsamples: lower-income countries, higher-income countries, lower-openness degree, higher-openness degree, lower-public debt levels countries, and higher-public debt levels countries. This section analyzes the sensitivity of the effect of financial development on non-resource tax revenue mobilization concerning the overall state of the economy, financial openness level, and debt level.

First, we focus on the level of economic development. Indeed, we search for a potential impact of the level of economic development on the effect of financial development by distinguishing between "low" and "high" GDP growth levels, using the median of GDP growth to separate the two groups. For low-income countries, the net impact of financial development on non-resource tax revenue mobilization in the short term is positive and significant (column [2]) and is 0.112 percentage points ($= 0.312 - 0.200$). The magnitude of this impact appears to be far higher than the net impact of this variable on non-resource tax revenue in high-income countries (column [3]), which is positive and significant and amounts to 0.108 percentage point. Moreover, results presented in columns [2]– [3] in Table 7 show that fiscal potential is more significant in "low-income" countries in most cases. Although financial development significantly improves tax revenue mobilization in both "high" and "low" levels of economic growth, the estimated coefficient of a financial product is more robust in "low-income."

Second, we examine the potential influence of financial openness. According to [Balima, Combes, and Minea \(2016\)](#), more open countries may attract more foreign investors and be more vulnerable to risk. Therefore, non-resource tax revenue mobilization could serve as a social protection tool and provide a "spare tire" for governments, particularly against adverse shocks affecting access to financial markets. Thus, we expect the estimated effect to be more critical in relatively more financial openness countries. We test this hypothesis by dividing the sample into "high" and "low" openness degrees, using the median level of the Chinn-Ito index to separate the two groups. For high-openness countries, the net impact of financial development on non-resource tax revenue

mobilization in the short term is positive and significant (column [4]) and is 0.227 percentage point. The magnitude of this impact appears to be far higher than the net impact of this variable on non-resource tax revenue in low-openness countries (column [5]), which is positive and significant and amounts to 0.014 percentage points ($= 0.227 - 0.213$).

Results depicted on lines [4]– [5] in Table 7 confirm our hypothesis, as estimated coefficients of financial development are larger in "high" openness contexts.

Third, we condition the effect of financial development on the debt levels by splitting our sample into "low" and "high" public debt levels, using the median of total government debt in % of GDP to separate the two groups. Indeed, significant debt levels make it more difficult to raise taxes since large debt may reflect less fiscal space (Ostry and al. 2010). Thus, we expect the estimated effect to be more critical in relatively less indebted countries. For low-debt countries, the net impact of financial development on non-resource tax revenues mobilization in the short term is positive and significant (column [6]) and is 0.409 percentage point. The magnitude of this impact appears to be far higher than the net impact of this variable on non-resource tax revenue in high debt countries (column [7]), which is positive and significant and amounts to 0.351 percentage point ($= 2.927 - 2.576$).

Results reported in columns [6]– [7] of Table 7 show that financial development significantly improves non-resource tax revenue mobilization exclusively in "low" debt countries, consistent with theoretical insights.

Table 7. Heterogeneity in the effect of financial development on non-resource tax revenue

Dependent variable: Log. Non-resource tax revenue over GDP	[1]	[2]	[3]	[4]	[5]	[6]	[7]
[1] Lag (log. Non-resource tax revenue over GDP)	0.731*** (0.059)	0.811*** (0.067)	0.893*** (0.045)	0.846*** (0.072)	0.879*** (0.071)	0.763*** (0.103)	0.881*** (0.089)
[2] Financial Development Index	0.290*** (0.095)	0.312** (0.152)	0.108* (0.064)	0.227* (0.127)	0.227* (0.127)	0.409* (0.243)	2.957** (1.152)
[3] Financial development*Low Income		-0.200*** (0.073)					
[4] Financial development*High Income			-0.050 (0.056)				
[5] Financial development*Low Openness				-0.213*** (0.065)			
[6] Financial development*High Openness					-0.238 (0.149)		
[7] Financial development*Low Debt ratio						-0.270 (0.284)	
[8] Financial development*High Debt ratio							-2.576** (1.089)
[9] Low Income		0.019 (0.029)					
[10] High Income			0.011 (0.034)				
[11] Low Openness				0.052** (0.021)			
[12] High Openness					0.074 (0.067)		
[13] Low Debt ratio						0.095 (0.108)	
[14] High Debt ratio							0.599** (0.258)
Observations/ Countries	976/46	458/44	518/45	534/36	442/26	554/40	422/36
Instruments	24	33	43	35	24	25	22
Hansen	0.629	0.217	0.479	0.317	0.365	0.567	0.872
AR1	0.000	0.010	0.036	0.009	0.062	0.001	0.000
AR2	0.985	0.429	0.691	0.454	0.565	0.576	0.987
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust Standard Errors are in parenthesis. The variables "Log. GDP growth", "Financial Development Index" and "Log. Trade Openness over GDP" has been considered as endogenous across all model specifications.

The variables "Log. Natural Rents", "Log. Agriculture over GDP", "Polity2" have been considered as exogenous.

²Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01

8 Conclusion

The main objective of this study was to analyze the relationship between financial development and tax revenue mobilization from theoretical and empirical perspectives in developing countries over the period 1995 to 2017. Our work contributes to the literature on this topic in several ways.

First, using an appropriate method, namely the GMM-system estimator, on a sample of 49 developing countries, we have shown that financial development contributes positively and significantly to non-resource tax revenue mobilization. This result is supported by an extensive set of robustness tests, including alternative tax revenue measures, additional covariates, and traditional measures of financial development for estimating the coefficient of our financial development variable.

Second, we explore possible heterogeneities of our findings by disaggregating the sample based on various economic and structural characteristics. We find that financial development increases non-resource tax revenues mobilization more in “low-income” compared to “high-income” countries. Moreover, we reveal that the beneficial effect of financial development on non-resource tax revenue is stronger in the “high” financial openness compared to “low” financial openness. Besides, we emphasize that the favorable effect of financial development on non-resource tax revenue mobilization is significant exclusively when public debt is relatively low.

Finally, we extend our analysis to examine the effect of components of financial development on domestic tax revenue mobilization in developing countries. We find that financial markets, financial institutions, financial markets depth, financial institutions' depth, financial markets access, financial institutions access, and the financial institutions' efficiency positively and significantly influence the government's ability to raise tax revenue, except for the financial institutions market's efficiency.

Given these results, this analysis provides straightforward and valuable policy recommendations. We believe that efforts should help developing countries, particularly low-income countries, build their financial systems to make valuable information easily accessible from these financial institutions. The low development of the financial sector has long been identified as one of the most binding constraints on economic growth, especially in developing countries. In this regard, spurring the development of a country's financial sector not only helps improve economic growth,

but also contributes positively to domestic tax revenue mobilization, which may improve the social welfare of the country at the same time.

Annexes:

Table A6

Definition and sources of variables.

Variables	Descriptions	Sources
Tax revenue	Tax revenue divided by GDP	World Development Indicators (WDI)
Non-Resource Tax Revenue	It is Calculated as total tax revenue (excluding grants and social contributions) minus resource tax revenue (% GDP).	International Centre for Tax and Development (ICTD).
Financial Development Index	Index for overall financial development	Financial Structure and Economic Development Database (FSED)
GDP growth	The annual percentage growth rate of GDP at market prices is based on constant local currency.	World Development Indicators (WDI)
Agriculture	Share of agriculture in aggregate value-added.	World Development Indicators (WDI)
Trade Openness	Sum of exports and imports of goods and services, % of GDP.	World Development Indicators (WDI)
Population density	The midyear population is divided by land area in square kilometers.	World Development Indicators (WDI)
Government debt	It includes domestic and foreign liabilities such as currency and money deposits, securities other than shares, and loans.	World Development Indicators (WDI)
Inflation	The annual percentage change of consumer price index.	World Development Indicators (WDI)
External debt	Total external debt stocks, % of GDP (External public and private sector debt)	World Development Indicators (WDI)
FDI net inflows	It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments	World Development Indicators (WDI)
Aid	Net official development assistance and official aid received (constant 2016 US\$)	World Development Indicators (WDI)
Natural resource rents	Total natural resources rents (percentage of GDP)	World Development Indicators (WDI)
Remittances	Remittances in percentage of GDP	World Development Indicators (WDI)
Control of corruption	Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	International Country Risk Guide (ICRG)
Polity2	Polity2 index	Polity4 Project
Capital openness index	It captures the degree of financial openness	Chinn and Ito (2008)
Liquid liabilities	Ratio of liquid liabilities to GDP	IMF's International Financial Statistics
Central bank assets	Claims on the domestic real nonfinancial sector by the Central Bank as a share of GDP	IMF's International Financial Statistics
Deposit money bank assets	Claims on the domestic real nonfinancial sector by deposit money banks as a share of GDP	IMF's International Financial Statistics
Private credit by money banks	Private credit by deposit money banks to GDP	IMF's International Financial Statistics
Private credit by money and other financial institutions	Private credit by deposit money banks and other financial institutions to GDP	IMF's International Financial Statistics
Financial institutions	The ² Financial institutions index	Financial Structure and Economic Development Database (FSED)
Financial markets	The Financial markets index	Financial Structure and Economic Development Database (FSED)
Financial institutions depth	The Financial institution's depth index	Financial Structure and Economic Development Database (FSED)
Financial institutions access	The Financial institution's access index	Financial Structure and Economic Development Database (FSED)
Financial institutions efficiency	The Financial institution's efficiency index	Financial Structure and Economic Development Database (FSED)
Financial markets depth	The Financial markets depth index	Financial Structure and Economic Development Database (FSED)
Financial markets access	The Financial markets access index	Financial Structure and Economic Development Database (FSED)
Financial markets efficiency	The Financial markets efficiency index	Financial Structure and Economic Development Database (FSED)

Appendix B. List of countries used in the analysis

Full Sample

Angola	Burkina Faso	Indonesia	Morocco	South Africa
Albania	China	Jamaica	Myanmar	Thailand
Argentina	Colombia	Jordan	Namibia	Togo
Azerbaijan	Costa Rica	Lesotho	Nepal	Tunisia
Bangladesh	Cote d'Ivoire	Madagascar	Paraguay	Ukraine
Belarus	Dominican Republic	Malaysia	Peru	Zambia
Bhutan	Gabon	Mali	Philippines	
Botswana	Ghana	Mexico	Russian Federation	
Brazil	Guatemala	Moldova	South Africa	
Bulgaria	India	Mongolia	Sri Lanka	

Appendix C. Pairwise correlation between variables used in the analysis.

Variable	Tax revenue	Non-Resource Tax Revenue	Financial Development	GDP growth	Trade Openness	Natural rents	Inflation	Agriculture	Polity2
Tax revenue	1.000								
Non-Resource Tax Revenue	0.6009*	1.000							
Financial Development Index	0.1307*	0.3649*	1.000						
GDP growth	-0.0539*	-0.1609*	-0.0509*	1.000					
Trade openness	0.4038*	0.2713*	-0.1188*	-0.0260	1.0000				
Natural rents	0.1928*	-0.2464*	-0.2074*	0.1916	0.1242*	1.0000			
Inflation	0.0749*	0.0824*	-0.0520*	0.0684*	0.0774*	0.2160*	1.0000		
Agriculture	-0.4537*	-0.3968*	-0.4435*	0.1910*	-0.2204*	0.0024	-0.0202	1.0000	
Polity2	-0.0946*	-0.1102*	0.1318*	-0.1746*	-0.0969*	-0.2866*	-0.0733*	-0.1870*	1.0000

Appendix D. Descriptive statistics on variables used in the analysis Descriptive statistics for main variables

Variable name	Obs	Mean	Std.Dev.	Min	Max
Tax revenue over GDP	1010	24.1954	10.0382	5.89	60.68
Non-Resource Tax Revenue over GDP	939	15.6737	6.3472	1.916	56.92
Financial Development Index	1058	0.2540	0.1434	0.0308	0.7299
GDP Growth	1057	4.4335	4.1270	-14.7586	34.4662
Trade Openness over GDP	1036	75.4580	33.8562	0.1674	220.407
Natural resource rents over GDP	1053	6.3340	8.3695	0.0227	55.8521
Inflation	1057	19.6206	168.061	-18.8992	4,800.53
Agriculture over GDP	1052	14.0530	10.1237	1.8283	57.2386
Polity2	1058	3.8449	5.5469	-10	10

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