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Access-for-all to Financial Services: Non-resources Tax Revenue-harnessing Opportunities in Developing Countries

Ali Compaoré[†]

Abstract

Financial inclusion refers to access to and use of formal financial services by individuals and businesses and the literature unambiguously documented that access-for-all to financial services is conducive to important economic and development outcomes. In this paper, we particularly investigate the impact of financial inclusion on non-resources tax revenue in developing countries. Based on a sample of 63 developing countries over the period 2004-2017 and drawing on the dynamic generalized method of moments (GMM), the paper finds that greater access to financial services captured by the number of ATMs per 100,000 adults increases government non-resources tax-to-GDP ratio, and this result is driven by households consumption and business expansion. Our findings provide insights on tax resources-harnessing opportunities from implementing and promoting financial inclusion policies for developing economies.

JEL Codes: G21; H20; O11; O23.

Key words: Financial inclusion, Non-resource tax-to-GDP ratio, Private consumption, Unemployment, Developing countries.

« Finance is the oxygen to the rest of the economy. It enables business to grow and people to manage risk. If you don't have finance, life is a lot more difficult. »

Peter Sands

[†] School of Economics – CERDI / CNRS - Université Clermont-Auvergne, Clermont-Ferrand / France. Email : ali.compaore@etu.uca.fr

I. Introduction

Financial inclusion refers to access to and use of formal financial services by individuals and businesses (Sahay *et al.*, 2015a).² A broader definition considers, in addition to the access and use of financial services, further aspects including the quality and range, usefulness and appropriateness, affordability, sustainability, and awareness of financial services and products as well as the consumer protection (Grace *et al.*, 2014; SBS 2014; BSP 2015; World Bank 2018; Jahan *et al.*, 2019; and Espinosa-Vega *et al.*, 2020), making financial inclusion a multifaced concept. The measurement of financial inclusion also remains an important issue in the empirical literature given to its multidimensional aspect. While some components are particularly more easily capturable, others dimensions are not readily observable.³ Over recent years, increasing attention has been paid to financial inclusion among both, policy-makers and academics considered as a key factor to achieve the 2030 Sustainable Development Goals (SDGs). Financial inclusion has become a priority of policy agenda in a number a of economies across the globe, with more than 50 countries having adopted a National Financial Inclusion Strategy (Espinosa-Vega *et al.*, 2020).

The consensus in the literature is that access-for-all to financial services is conducive to important economic and development outcomes, though access to finance still constitutes a major constraint for business creation and expansion in developing countries (World Bank, 2014; Demirgüç-Kunt *et al.*, 2015). Financial inclusion is important for inclusive and sustainable economic growth and non-access to formal financial services including bank account entails greater cash transactions is associated with higher transaction fees and financial risks (Lusardi, 2010). Greater financial inclusion positively affects the GDP, while reducing inequality in developing and emerging (Dabla-Norris *et al.*, 2015). Similarly, focusing on Latin America and the Caribbean (LAC) countries, Dabla-Norris *et al.* (2015) conclude that easing financial services access including relaxing collateral constraints helps reduce inequality and spur growth. Using a wide sample of 123 countries, Allen *et al.* (2015) highlight that financial inclusion is associated with stronger legal rights and more politically stable environments.

Micro level and field experiment studies evidenced that microfinance branch expansion and access to credit facilities is conducive to business expansion and entrepreneurial activities

² Financial inclusion is different from financial development. The latter occurs when financial instruments, markets, and intermediaries ameliorate – the effects of information, enforcement, and transactions costs and therefore do a correspondingly better job at providing the five financial functions (Levine, 2005) – though the former is a dimension of the latter (see e.g. Sahay *et al.*, 2015). In addition, a more financial development may allow greater access to financial services as emphasized in Rajan and Zingales (2003).

³ See Espinosa-Vega *et al.* (2020) for a complete discussion.

development (Bruhn and Love, 2014; Angelucci, *et al.*, 2015; Fareed *et al.*, 2017). Similarly, Banerjee *et al.* (2010) show that access to microcredit increases small business investment and profits of preexisting businesses in India. Focusing on the Bosnia, Augsburg *et al.* (2015) also highlight that lower rejection of households' formal loans applications induces higher self-employment, increases in inventory and an increase in the labor supply in the household's business. Similarly in rural Kenya, Dupas and Robinson (2011) provides a strong evidence that extending basic banking services (e.g. saving accounts) is associated to an increase in the size of market women businesses. In line with the disciplining effect of group lending, Attanasio *et al.*, (2011) find a positive impact of access to group loans on entrepreneurship in Mongolia. Access to group loans increases the likelihood of owning an enterprise by 10 percent. Financial inclusion is found be an important tool for empowering women and strengthening female decision-making power in developing countries. Ashraf *et al.* (2010) relying on a randomized controlled trial finds that access to basic financial service such as saving accounts is associated to an greater in female decision-making power within the household in the Philippines.

The literature also asserted that financial inclusion positively affects households consumption as well as households income (Banerjee *et al.* 2010; Karlan and Zinman, 2010; Attanasio *et al.*, 2011; Dupas and Robinson, 2011; Bruhn and Love, 2014; Zhang and Posso, 2017). Access to financial services allows households to respond to income shocks by raising their current consumption (Bhattacharya and Patnaik, 2015) and facilitates households consumption smoothing and softens output volatility cost (Mehrotra and Yetman, 2015). In addition, greater access to financial services encourages households' saving. Aportela (1999), based on natural experiment shows that the financial inclusion increased the average saving rate of households by around 5 percentage points and this effect was even higher for the poorest households in Mexico. Furthermore, access to financial service favors human capital development and increases jobs opportunities (Demirgüç-Kunt *et al.*, 2008). For instance De Gregorio (1996) on an overlapping generations model with endogenous growth highlights that access to financial services is associated with an increase in human capital accumulation and growth in OECD and developing countries.

Subsequent studies explored the impact of access to financial services on the level of poverty (Burgess *et al.*, 2005; Burgess and Pande, 2005; Honohan, 2004a,b; Honohan, 2005, 2006; Karlan and Zinman, 2010; Kiendrebeogo and Minea, 2013; Bruhn and Love, 2014; Banerjee *et*

al., 2015; Rewilak, 2017) and find that access to basic financial services is associated with a decrease in the poverty rates. For instance, Coulibaly and Yogo (2018) recently evidenced that improving financial outreach through additional bank branches reduces the number of poor workers in developing countries.

Nevertheless, parallel to this literature, some studies have documented that a greater access to financial services without proper financial supervision might be harmful to economic outcomes and result into financial distress (Rajan, 2010; Han and Melecky, 2013; Sahay *et al.*, 2015). For instance high financial inclusion combined with a boom in access to credit is associated to a deterioration in credit quality and thereby leading to financial risks (Mehrotra and Yetman, 2015). In addition, Dabla-Norris *et al.* (2015) analyzing factors constraining firms to access to finance find that greater access to credit could result in bank instability by increasing non-performing loans.

Although Čihák and Sahay (2018) postulate that inclusive financial systems can increase the effectiveness of fiscal policy by broadening the tax, studies exploring the potential effect of accessing to financial services on government tax revenue are very scarce (Oz-Yalaman, 2019). In addition, studies particularly focusing in developing countries and using non-resources tax revenue is non-existent. To the best of our knowledge, our paper is therefore the first to provide a strong and convincing evidence on the nexus between financial inclusion and non-resources tax ratio in developing countries. Our contribution to the literature relies on the use of comparable⁴ tax revenue ratio excluding natural resources revenue. As underscored in Caldeira *et al.* (2020), distinguishing resource from non-resource revenue is highly relevant to understand tax capacity in developing countries and the literature has well-documented a *crowding-out* effect between resources revenue and non-resource tax revenue (Bornhorst *et al.*, 2009; Crivelli and Gupta, 2014; James, 2015 among others). In addition, unlike the empirical method employed in Oz-Yalaman (2019), we adopted a dynamic specification to account for the inertia in government tax revenue.

Using a sample of 63 developing countries over the period 2004-2017 and drawing on the dynamic generalized method of moments (GMM) to solve the endogeneity and any reverse causality issue, the paper shows that greater access to financial services captured by the number of ATMs per 100,000 adults increases government non-resources tax-to-GDP ratio. Looking at

⁴ Oz-Yalaman (2019) explored the nexus between financial inclusion and tax revenue but using different sources of total tax revenue and tax subcomponents. This entails important shortcomings since the datasets are not strictly comparable (Sahay *et al.*, 2015).

the tax revenue structure, the results show that indirect taxes revenue accounts the most sizeable positive effect of increased penetration of ATMs on tax revenue. Exploring the channels through which financial inclusion influences non-resource tax ratio, our empirical results highlight that the positive effect of greater access to financial services mainly operates through private consumption and business expansion. Our results survive to a battery of robustness exercises including: (1) adding more control variable namely the level of education, inflation, the population size, external aid received, domestic financial sector development, remittances inflows and the tax structure, (2) the use of alternative financial inclusion measures to capture the multifaceted aspect of our interest variable and (3) using alternative tax data source.

This paper provides insights to countries that have implemented or are in the process of implementing financial inclusion policies, on tax revenue-harnessing opportunities from access-for-all financial services.

The remainder of the paper is structured as follows: the second section describes the econometric methodology and introduces the dataset with some stylized facts. Section 3 presents the baseline results from the empirical specification and considers some robustness checks. Section 4 provides concluding remarks and draws policy implications.

II. Empirical methodology and data

A. Econometric model

The following dynamic panel model that captures the impact of financial inclusion on non-resources tax revenue was estimated:

$$NRTax_{i,t} = \alpha + \beta NRTax_{i,t-1} + \psi FInc_{i,t} + \mathbf{Z}_{i,t} \delta + \lambda_i + \zeta_t + \varepsilon_{it} \quad \mathbf{Eq. [1]}$$

$NRTax_{i,t}$ is the non-resource tax-to-GDP ratio for country i at time t . We included the one-period lagged value of the dependent variable $-NRTax_{i,t-1}$ because of the inertia in the total tax revenue. $FInc_{i,t}$ is the financial inclusion indicator and $\mathbf{Z}_{i,t}$ is a set of variables that explain the government tax revenue ratio. λ_i and ζ_t denote time-invariant country-level characteristics and time-varying factors, respectively that could potentially affect the tax ratio. The last term, ε_{it} is an idiosyncratic disturbance.

Taking stock of previous literature on the principal determinants of the tax share in GDP, the vector $\mathbf{Z}_{i,t}$ includes *inter alia* the level of development, the sectoral composition of value added (i.e. agriculture and natural resources), the trade openness and the quality of institutions. The

real GDP per capita is commonly used to capture countries' overall level of development. Countries' tax capacity is intrinsically related to their level of development (Lotz and Morss, 1967; Tanzi 1983; Pessino and Fenochetto, 2010; Fenochetto and Pessino, 2013; Crivelli and Gupta, 2014). High income countries are expected to raise more tax revenue than developing countries due to the more efficient and strong tax administration, higher degree of economic and institutional sophistication. To capture the non-linearity effect of the level of development and tax capacity, we include the squared of this variable in the specification.

Trade openness refers to the volume of international trade in the GDP. Substantial increase in trade volume makes it more amenable to taxation through domestic consumption and corporate profits (Chelliah *et al.*, 1975; Leuthold, 1991; Tanzi, 1992; Stotsky and WoldeMariam, 1997; Stotsky and WoldeMariam, 2006; Pessino and Fenochetto 2010; Gnanon and Brun, 2018).

The effect of **natural resources rents** on tax revenue ratio is widely evidenced in the literature but remains controversial. While pioneering studies evidenced a positive effect of natural resource rent on tax revenue (Chelliah *et al.*, 1975 and Tanzi, 1992), recent resource curse literature highlights a negative association between natural resources rents and government tax revenue, suggesting a *crowding-out effect* (Sachs and Warner, 2001; Eltony, 2002; Bornhorst *et al.*, 2009; McGuirk, 2013; Crivelli and Gupta, 2014; James, 2015; Belinga *et al.* 2017). Therefore, effect of natural resources rents on tax revenue is *à priori* ambiguous.

The share of **agriculture in the GDP** is found to be negatively associated with non-resources tax ratio (Chelliah *et al.*, 1975; and Tanzi, 1992; Stotsky and WoldeMariam, 2006). Developing countries are still featured by large shares of subsistence agricultural sector exerted by small farmers which is not generating taxable surpluses. In addition, this sector is more often subject to tax exemptions considered as sector providing food for subsistence (Stotsky and WoldeMariam, 2006)

We proxy the **quality of institutions** by the polity2 index assessing the degree of democracy. High and strong economic and political institutions are expected to promote adequate tax administrations allowing more tax revenue collection (Davoodi and Grigorian, 2007); Gupta, 2007; Gordon and Li, 2009; Clist and Morrissey, 2011; Fenochetto and Pessino, 2013; Feger and Asafu-Adjaye, 2014), while lower quality of institutions portrayed by higher corruption is a threat for tax revenue collection as it affects tax administration and tax officers and occasioning tax evasion.

Equation [1] is a dynamic specification since the non-resource tax-to-GDP ratio at period t depends on its own past realizations. Thus, relying on classical linear Ordinary Least Squares (OLS) estimator would lead to inconsistent and biased results (Nickel, 1981; Wooldridge, 2002). The appropriate estimator for dynamic panel data models appears to be the popular Generalized Method of Moments (GMM). The GMM estimator is designed for dynamic specifications with “*small-T, large-N*”⁵ panels and allows to tackle potential issues of endogeneity, simultaneous and omitted variables bias. Hence, this estimator will allow, not only to correct the possible endogeneity of our interest variable –financial access– but also to correct for endogeneity of all right-hand side variables by using the lagged values as instruments (one to two lags). Our analysis specifically relied on the system-GMM proposed by Blundell and Bond (1998) with the two-step estimator. However, the validity of the GMM estimation relies on the main assumption that instruments are exogenous (Roodman, 2009). Therefore we resort to Hansen’s test for over-identifying restrictions to check the validity of the instruments. Another condition that validates the GMM estimator is the absence of second-order serial correlation in the residuals in difference. Accordingly, the Arellano-Bond's test is used check that condition.

B. Data and some stylized facts

The study is conducted on a sample of 62 developing countries over the period 2004-2018, based on data availability.⁶ The dataset consists in an yearly unbalanced panel because of missing observations and is compiled from various sources including the World Bank’s Worldwide Development Indicators (WDI), the International Monetary Fund’s World Economic Outlook (WEO), Penn World Tables (PWT9.1) and the Polity4 project.⁷

Tax revenue data come from the most recent ICTD/UNU-WIDER, Government Revenue Dataset⁸ (henceforth ICTD dataset) though there are currently several of available sources of cross-country tax revenue data including the World Bank, the Organization for Economic Co-operation and Development (OECD), and the Comisión Económica para América Latina y el Caribe (CEPAL). This dataset combines several major international databases, as well as

⁵ Meaning few time periods and many individuals, which is the case with our sample.

⁶ The developing countries category considered in this paper refers to the World Bank income classification, hence including low-income and middle-income countries. The complete country list by region is provided in Table A1 of Appendices.

⁷ See Table A2 for complete definition and sources of variables.

⁸ The database is available at <https://www.ictd.ac/dataset/grd/>

drawing on data compiled from all available International Monetary Fund (IMF) Article IV reports (Prichard *et al.*, 2014). ICTD dataset has the advantage to be available for a large number of developing countries which is the focus of this study. More importantly, unlike alternative databases, ICTD dataset has the particularity to exclude natural resource revenue tax revenue⁹, then providing a non-resource tax revenue data. As stressed in Caldeira *et al.* (2020), distinguishing resource from non-resource revenue is highly relevant to understand countries' tax effort and some studies in the literature highlight a crowding-out effect between resources revenue and non-resource tax revenue (Bornhorst *et al.* 2009; McGuirk, 2013; Crivelli and Gupta, 2014). A competing rich non-resource tax revenue dataset was developed by Mansour (2010) covering 1980-2010 and recently updated to 2015 (see Caldeira *et al.*,2020). However, this database only focuses on 42 Sub-Saharan African countries. We therefore relied on ICTD dataset for coverage purpose. Tax data used in this paper cover six tax series namely: (i) total tax revenue; (ii) indirect taxes; (ii) direct taxes; (iv) income taxes; (v) taxes on goods and services, and (vi) value-added tax, all expressed as percentage of GDP.

Data on financial inclusion are extracted from the IMF's Financial Access Survey database¹⁰ and include 8 indicators of financial access : (i) the number of automated teller machines (ATMs) per 100,000 adults; (ii) the number of commercial bank branches per 100,000 adults; (iii) the number of loan accounts with commercial banks per 1,000 adults; (iv) number of depositors with commercial banks per 1,000 adults; (v) number of credit unions and credit cooperatives; (vi) outstanding deposits with commercial banks; (vii) number of depositors with commercial banks, and (viii) loan accounts with commercial banks. Higher values of these indicators suggest a greater degree of financial access.

Focusing on the number of ATMs per 100, 000 adults, the Figure 1 shows an upward trend in developing countries, suggesting that financial access is advancing. More precisely, the number of ATMs/ 100,000 adults recorded a considerable progress moving form 13 ATMs per 100, 000 adults in 2004 to 45 ATMs in 2017, on average. However this remains low compared to developed countries with 21 and 63 ATMs for 100,000 people in 2004 and 2017, respectively.

Figure 1. Financial inclusion over time

⁹ See Prichard *et al.* (2014) and Caldeira *et al.* (2020) for further discussion.

¹⁰ Data available at <https://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C>

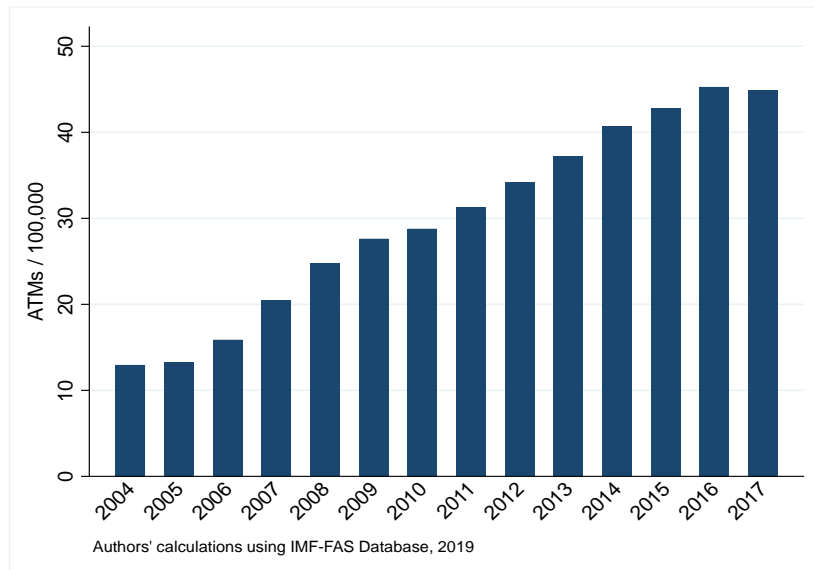
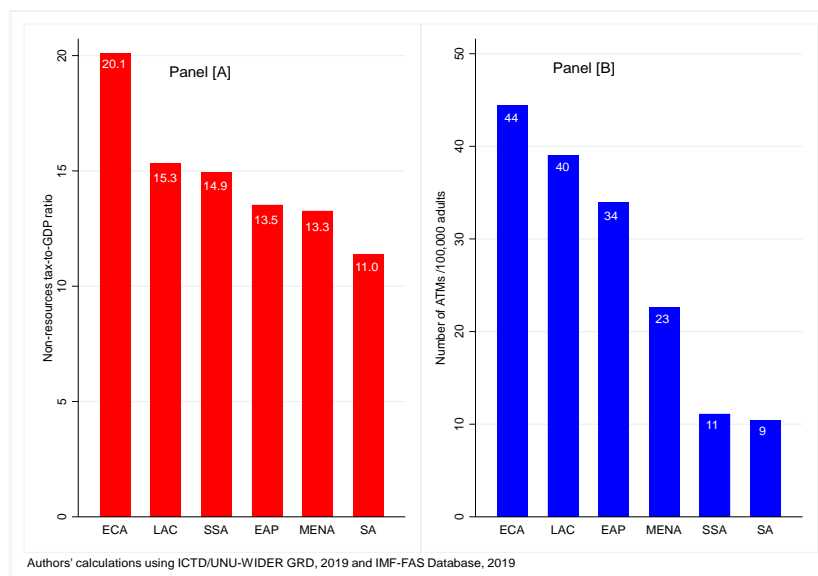


Figure 2 depicts countries' tax collection performance measured by the non-resource tax-to-GDP ratio as well as the level of financial access proxied by the number of ATMs per 100,000 adults across regions (Panel [A] and [B], respectively). It emerges that Europe and Central Asia (ECA) and Latin America and Caribbean (LAC) countries have the higher level of financial access in the sample, with on average 44 and 40 ATMs for 100,000 adults, respectively. In the same time, those countries appear to be the top performers in terms of tax revenue collection with a non-resource tax-to-GDP ratio of 20.1 and 15.3 per cent on average, respectively. In

Figure 2. Non-resource tax-to-GDP ratio and ATMs, by region (average values)

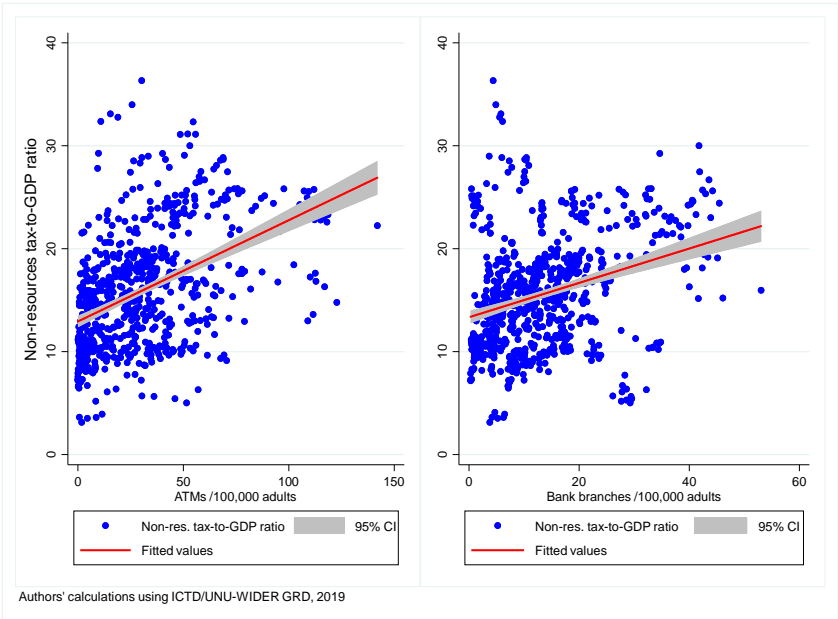


Note: ECA= Europe and Central Asia; LAC= Latin America & Caribbean; SSA= Sub-Saharan Africa; EAP: East Asia & Pacific; MENA=Middle East and North Africa; SA= South Asia.

contrast, it comes out that the level of accessing to financial services is very low in South Asia (SA) and Sub-Saharan Africa (SSA) countries with on average, 9 and 11 ATMs for 100,000 adults, respectively. SA is the lower performer region of the sample in terms of tax revenue raising, with an average tax-to-GDP ratio of 11.9. SSA countries have been making tremendous efforts to collect tax revenue (14.9 percent of GDP on average) over recent years as a result of important tax policy and administration reforms (Mansour and Rota-Graziosi, 2013; Ebeke *et al.*, 2016) but still have room for greater tax collection. For instance, Caldeira *et al.*, (2020) stressed that SSA countries could raise up to 22.75 percent of GDP in non-resource taxes if they fully exploit their tax potential.

In figure 3 we provide the correlation between to financial access indicators –the number of ATMs and branches per 100,000 adults¹¹– and the total non-resource tax-to-GDP ratio. It clearly appears that more access to financial services is associated with greater tax revenue mobilization.

Figure 3. Correlation between the number of ATMs and branches and non-resource tax ratio



III. Results

A. Baseline results

Table 1 reports the system GMM-based estimates of the effect of financial inclusion on the non-resource tax-to-GDP ratio in developing countries as specified in equation [1]. Column [1] show

¹¹ Note that these two indicators have been adopted by the international community to monitor target 8.10 of 2030 Sustainable Development Goals (SDGs) which aims at strengthening the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all.

the results for total non-resources tax ratio, while remaining columns (Columns [2]-[6]) display the results for different tax revenue subcomponents as mentioned above.

Resorting to the number of ATMs as a proxy for access to financial services, our empirical results evidence a positive relationship between financial inclusion and non-resources tax revenue. The coefficient associated with financial inclusion is positive and statistically significant at 1% level for total non-resource tax (Column [1]). In addition, The *p-values* of the Hansen test and the Arellano–Bond tests for serial correlation (AR(1) and AR(2)) are reported at the bottom of the table and confirm all the validity of our econometric approach.¹² Our results are in line with previous studies (Oz-Yalaman, 2019).

Regarding, the composition of tax revenue, the results also support a positive relationship between financial access and all subcomponents of total tax revenue (Column [2]-[6]). More specifically, the coefficient associated with financial inclusion is more sizeable for indirect taxes (Column [2]) compared to the one for direct taxes (Column [3]). This might suggests that more access to financial services allows for greater total tax revenue mobilization through an increased consumption and thereby more consumption taxes to collect. This is confirmed by the positive and statistically positive coefficient of financial inclusion on taxes on goods and services (Column [5]), as well as on valued-added taxes (Column [6]).

Turning to the control variables, the results indicate that the level of development measured by the real GDP per capita and the quality of the institution appear to be relevant determinants of non-resources tax ratio in developing countries and are positively and significantly associated with tax ratio. These findings are consistent with previous evidences (Pessino and Fenchietto, 2010; Fenchietto and Pessino, 2013; Crivelli and Gupta, 2014; Davoodi and Grigorian, 2007); Gupta, 2007; Gordon and Li, 2009; Clist and Morrissey, 2011; Fenchietto and Pessino, 2013; Feger and Asafu-Adjaye, 2014) that countries' tax capacity is related to their level of development and good quality of institution is favorable to greater tax revenue collection. The results also confirm our hypothesis of non-linearity between the level of development and the capacity captured by the negative a significant coefficient associated with the squared of real GDP per capita. In line with previous findings (Tanzi, 1992; Stotsky and WoldeMariam, 2006; Bornhorst *et al.*, 2009; Pessino and Fenchietto, 2010; McGuirk, 2013; Crivelli and Gupta, 2014), natural resources rents, trade openness and agriculture value-added are also determining

¹² See Roodman (2009) for a complete discussion on GMM method.

factors of non-resources tax subcomponents (columns [2], [3] and [4]), while they appear to be non-significant on the total tax ratio.

Table 1. Baseline results

	<i>Dependent variable: Non-resource tax-to-GDP ratio</i>					
	[1]	[2]	[3]	[4]	[5]	[6]
	Tot. Tax	Indirect	Direct	Income	Gds & Serv.	VAT
Dep. variable (lagged)	0.88087*** (0.040)	0.95022*** (0.029)	0.89339*** (0.046)	0.86664*** (0.028)	0.89699*** (0.063)	0.85310*** (0.049)
ATMs /100,000 adults (Log)	0.41695*** (0.111)	0.21179* (0.112)	0.13574** (0.069)	0.21482** (0.100)	0.20143** (0.089)	0.14093** (0.068)
Real GDP_pc	0.00023** (0.000)	0.00008 (0.000)	0.00017** (0.000)	0.00020** (0.000)	0.00018** (0.000)	0.00007 (0.000)
Squared real GDP_pc (Log)	-0.09120** (0.039)	-0.04770** (0.024)	-0.05683** (0.028)	-0.07897*** (0.029)	-0.08599*** (0.028)	-0.03524 (0.027)
Total natural resources rents (Log)	0.01585 (0.069)	0.05669 (0.044)	0.13293** (0.061)	0.15840*** (0.049)	-0.04089 (0.053)	0.02269 (0.033)
Trade openness	0.90547 (0.566)	0.68684** (0.326)	0.63542* (0.335)	0.46477* (0.269)	0.12896 (0.356)	0.30823 (0.316)
Agriculture value added	-0.01669 (0.033)	-0.03456 (0.025)	-0.02782 (0.028)	-0.05122*** (0.019)	-0.04956 (0.031)	-0.00905 (0.027)
Polity2 index	0.03620*** (0.013)	0.01396 (0.011)	0.02366 (0.024)	0.01393* (0.008)	0.02252** (0.009)	0.03557** (0.015)
Constant	0.00000 (0.000)	0.00000 (0.000)	0.00000 (0.000)	3.19583 (2.053)	0.00000 (0.000)	0.00000 (0.000)
Observations	566	534	494	522	548	478
Countries	61	58	55	59	58	54
AR(1) <i>p-value</i>	0.000	0.001	0.000	0.003	0.000	0.001
AR(2) <i>p-value</i>	0.826	0.267	0.443	0.552	0.710	0.852
Hansen OID (<i>p-value</i>)	0.226	0.187	0.653	0.041	0.443	0.120
Nb. of instruments	35	38	30	41	27	26
Year FE	YES	YES	YES	YES	YES	YES

*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in brackets. Note: The number of instruments is strongly limited-starting with the second lag of the dependent variable and the first lag of the control variables- to avoid the over-fitting problem. In all specifications, the null hypothesis for lack of first-order (AR(1)) serial correlation in the first-differenced error terms is rejected, while not rejected for the second-order (AR(2)). In addition, the robust (to heteroskedasticity and autocorrelation) Hansen's p-value validates the over-identification restrictions. All of these statistical tests validate the econometric method and the lagged variables can be safely used as instruments. This applies for all regressions in the paper

B. Transmission channel

In this section explore the main channels through which financial inclusion influences non-resource tax ratio. As stressed above, financial inclusion leads to increased household consumption and business development. Relying on this literature, we expect financial inclusion to affect tax revenue through an increased business development and private consumption. Easy access to financial services allow both households and firms (e.g. SMEs) with credit facilities to finance productive investments and increase consumption which in turn generate both, income¹³ and consumption taxes and for public sector. In addition, financial inclusion would positively affect tax revenue through business development based on the

¹³ Taxes on income, profits, & capital gains: corporations

rational that business expansion is associated with job creation¹⁴ (i.e. decrease in unemployment rate) and income generation for households, thereby income taxes to collect. We proxy the households consumption by the private consumption per capita, while the business development induced-effect of financial inclusion is captured through the unemployment rate. However, since these transmission channels might be direct or indirect, we proceeded in two steps: first, we estimate the effects of financial access on each channel, then we estimate the effects of each variable on the total non-resource tax ratio.¹⁵

The first step estimation results are reported in Tables 2. The results show that more access to financial services is associated with greater private consumption (column [1]) and lower unemployment rate (column [2]), confirming previous findings.

Table 2. Transmission channels

	Private consumption_pc	Unemployment
	[1]	[2]
ATMs /100,000 adults (Log), t-1	0.09155*** (0.018)	-3.07251* (1.638)
Debt to GDP ratio, t-1	-0.00007 (0.001)	0.00961 (0.026)
Real GDP_pc, t-1	0.00012*** (0.000)	0.00164 (0.001)
GDP growth, t-1	0.00125 (0.001)	0.01854 (0.041)
Gross fixed capital formation / GDP, t-1	-0.00136 (0.002)	-0.34860** (0.138)
GINI index, t-1	-0.00117 (0.003)	-0.09378 (0.108)
Trade openness, t-1	-0.00325 (0.052)	-5.84236* (3.184)
Log inflation, t-1	-0.00820*** (0.002)	0.02292 (0.124)
Human capital index, t-1	0.04621 (0.118)	-3.31473 (6.625)
Constant	6.97473*** (0.347)	52.15080* (27.423)
Observations	204	220
Countries	33	39
R-squared	0.814	0.396

*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Robust standard errors are reported in brackets. Note: fixed effects are included

¹⁴ [Teima et al. \(2010\)](#) highlighted that SMEs contribute up to 45 percent of employment in developing countries.

¹⁵ An alternative popular approach in the literature to test whether the effect of financial inclusion on non-resource tax-to-GDP ratio would transmit through the considered channels, consists to run our baseline regression interacting the financial inclusion indicator with each transmission channel (see e.g. [Caballero, 2016](#); [Compaore et al., 2020](#) among other). If the coefficients associated with financial inclusion indicator works out to be non-significant when the interactive terms and the transmission channels are included, we then conclude that the effect financial inclusion on tax revenue can be assumed to operate through private consumption and job creation as a results of business development and expansion. Based on this approach, the results also confirm our hypothesis and are available upon request.

In Table 3, we report the results of the effect of the transmission channels on our tax variable. In line with our main hypothesis, households private consumption is positively and significantly associated with total non-resources tax ratio, as well as different tax subcomponents (Panel [A], columns [1]-[6]). Greater private consumption generates important consumption tax revenue to collect including value-added tax. It is worth noting that value-added tax has become one of the most important tools of revenue mobilization in the developing world with about one-quarter of total tax revenue is raised through value-added tax. (Keen and Lockwood, 2006, 2016 Gerard and Naritomi, 2018). Value-added tax also presents the advantage to be less distortionary in addition to its *self-enforcing* properties (Kopczuk and Slemrod, 2006).

In Panel [B] of Table 3, we present the results using the unemployment rate. It emerges that the unemployment rate is negatively link to total tax ratio (column [1]), as well as income taxes and value-added tax (columns [1] and [6], respectively). Financial inclusion reduces unemployment by increasing business and enhancing income-generating activities, hence providing opportunities to collect income taxes both on individuals and corporates.

Overall, our results confirm that financial inclusion is conducive to greater tax revenue collection through private consumption and business expansion.

Table 3. Effects of transmission channel variables on tax revenue variable

	[1]	[2]	[3]	[4]	[5]	[6]
	Tot. Tax	Indirect	Direct	Income	Goods & Serv.	VAT
Panel [A]: Private consumption						
Private consumption_pc (log)	4.47171*** (1.061)	2.23892*** (0.807)	2.69600*** (0.474)	1.93726*** (0.610)	2.15500*** (0.750)	1.57607** (0.665)
Constant	-17.83325** (7.979)	-6.19513 (6.065)	-14.90227*** (3.576)	-8.93711* (4.588)	-7.90796 (5.649)	-6.69822 (4.996)
Observations	416	383	364	381	384	326
Countries	37	35	35	36	35	32
R-squared	0.180	0.073	0.272	0.109	0.110	0.133
Panel [A]: Unemployment						
Unemployment	-0.05045* (0.025)	-0.01662 (0.021)	-0.02540 (0.019)	-0.05030** (0.024)	0.00001 (0.018)	-0.02348* (0.013)
Constant	16.60980*** (0.205)	11.10105*** (0.174)	5.66047*** (0.156)	6.12380*** (0.197)	8.85711*** (0.149)	6.10331*** (0.107)
Observations	443	416	385	416	426	381
Countries	56	55	51	55	56	53
R-squared	0.015	0.003	0.011	0.023	0.000	0.013

*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Robust standard errors are reported in brackets. Note: fixed effects are included

C. Robustness checks

In this section, we undertake three robustness exercises to check the validity of our findings. First, we test the sensitivity of the results from the baseline specification to additional control variables, including the level of education, inflation, the population size, external aid received, domestic financial sector development, remittances inflows and the tax structure.¹⁶ Higher level of education is expected to increase tax compliance. Similarly, a large population, a well-functioning financial sector and remittances flows received are positively associated with tax ratio, while higher inflation episodes and external assistance are negatively linked to tax collection capacity.

Table 4. Robustness check: adding more control variable

	<i>Dependent variable: Total non-resource tax-to-GDP ratio</i>						
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Dep. variable (lagged)	0.83851*** (0.065)	0.85198*** (0.068)	0.84004*** (0.053)	0.84156*** (0.066)	0.92508*** (0.044)	0.89801*** (0.047)	0.96098*** (0.049)
ATMs /100,000 adults (Log)	0.37651** (0.161)	0.35622** (0.163)	0.41247*** (0.115)	0.37169*** (0.132)	0.40795*** (0.140)	0.43021*** (0.158)	0.67880** (0.327)
Human capital index	0.26274 (0.565)	0.06969 (0.649)	0.19853 (0.437)	0.00372 (0.569)	-0.34542 (0.425)	-0.34912 (0.423)	-1.07822 (0.704)
Log inflation		-0.01366 (0.028)	-0.00528 (0.027)	-0.01874 (0.032)	0.00513 (0.021)	0.01492 (0.020)	0.00361 (0.034)
Log total population			0.18675* (0.107)	0.15694 (0.169)	-0.27982 (0.174)	-0.25708 (0.184)	0.13004 (0.520)
Log Net ODA received_pc				-0.27082* (0.148)	-0.09633 (0.082)	-0.04720 (0.090)	0.07013 (0.277)
Financial markets efficiency					1.56812*** (0.567)	1.39023** (0.639)	1.60892** (0.753)
Remittances (% GDP)						0.00880 (0.022)	-0.01429 (0.029)
Tax diversification							2.17651* (1.121)
Control variables	YES	YES	YES	YES	YES	YES	YES
Observations	460	454	454	431	431	424	248
Countries	55	55	55	54	54	53	34
AR(1) <i>p-value</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.025
AR(2) <i>p-value</i>	0.930	0.774	0.978	0.743	0.440	0.263	0.866
Hansen OID (<i>p-value</i>)	0.419	0.183	0.534	0.584	0.370	0.144	0.177
Nb. of instruments	26	26	36	32	35	37	37
<i>Year FE</i>	YES	YES	YES	YES	YES	YES	YES

*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in brackets. Note: Constant terms, as well as vector X variables are included but not reported for space purpose. Complete tables are available upon request.

Results are reported in Table 4 and are similar to baseline findings. The coefficients associated to the population size, financial sector development and tax diversification index are positive and significant (columns [3], [5] and [7], respectively). A large population constitutes a

¹⁶ These variables are considered in the literature as possible determinants of tax revenue (see e.g. [Tanzi, 1977](#), [Gupta et al. 2014](#), [Gordon and Li, 2009](#), [Pessino and Fenochietto, 2010](#), [Clist and Morrissey 2011](#), [Ebeke, 2011](#), [Benedek et al. 2012](#), [Asafu-Adjaye \(2014\)](#), and [Compaore et al., 2020](#) among others)

potential for tax collection. In addition, a well-developed financial sector combined with a greater access to credit allow individuals and corporates to finance profitable projects, which in turn favor tax contribution. Having a diversified tax base is associated with greater tax revenue collection. The results also show that inflation harms tax revenue mobilization (column [4]), corroborating the *Tanzi effect*.

Second, up to now, we used the number of ATMs per 100,000 adults to measure financial inclusion in developing countries. However, financial inclusion is a multifaceted concept which encompasses various dimensions (Espinosa-Vega *et al.*, 2020). In addition, the mode of accessing to financial services varies by country and is changing over time. For instance, developing countries are increasingly shifting from traditional banking toward digital banking and finance with an important use of mobile money. Hence, relying on traditional banking may poorly capture the real state of financial inclusion.¹⁷ Furthermore, as stressed in Coulibaly and Yogo (2019), ATMs as well as bank branches in developing countries may be unevenly distributed within countries and tend to be more often concentrated in large cities (Guerineau and Jacolin, 2014). Hence, people in rural areas will not get access to financial services. Finally, our baseline financial inclusion measure does not take into account microfinance institutions (MFIs), credit unions or financial cooperatives which play a pivotal role in providing financial services in developing countries. We therefore paid a particular attention to these shortcomings by considering several alternative indicators to capture financial access in a more comprehensive way. The results are reported in Table A4 and overall, they support those presented in Table 1.

We finally exploit an alternative data source to test the validity of our findings. As mentioned above, several tax data sources have been used in the literature. In this robustness exercise, we use the IMF's GFS tax database which also provides detailed classification of government's tax revenues. Table A5 of appendices reports the estimation results. The results show that the coefficients associated with financial inclusion are positive and strongly significant at the 1 percent level for total tax revenue (column [1]) and some tax subcomponents (columns [3], [4] and [6]). Therefore, our baseline findings remain valid.

IV. Conclusion

In this paper, we empirically examined the relationship between access to financial services and non-resources tax-to-GDP ratio in developing countries. Relying on the popular system-GMM

¹⁷ We point out this point but data scarcity do not allow us include a financial inclusion indicator capturing mobile and digital banking (e.g. the number of registered and active mobile money agent outlets).

estimator of [Blundell and Bond \(1998\)](#), this paper is the first, to the best of our knowledge, to take into account the inertia in the tax revenue ratio and the possible endogeneity of financial inclusion as well all control variables. Based on a panel data of 62 developing countries over the period 2004-2017, the paper finds that financial inclusion is positively and significantly associated with non-resources tax revenue. Exploring the effect on the tax structure, the results show that access to financial services has more sizeable effect on indirect taxes than the rest of total tax subcomponents. Our paper also provided empirical evidence that financial inclusion is inducive to greater tax revenue mainly through increased private consumption and business expansion. Furthermore, in line with previous evidence, our results show that the level of development as well as the quality of institutions are important determinants of tax ratio and are positively associated with tax revenue performance in developing countries. However the relationship between the level of overall development turns out to be non-linear, suggesting the existence of a tipping point.

In terms of policy recommendation, our study concurs with previous findings and call for an improved and greater access to financial services. In view of the pressing financing needs to finance structural investments in the developing world, our paper provides insights to countries that have implemented or are in the process of implementing financial inclusion policies, on tax resources harnessing opportunities from better access to financial services. In addition, in the current particular context of coronavirus (Covid-19) pandemic causing severe economic despair across the world and requiring important financial resources for a timely and appropriate response, unlocking access to financial services will help to better cope with the income shock and smooth households consumption.

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Appendices

Table A1: Country list

Region	Country	Region	Country
LAC	Argentina	ECA	Albania
	Bolivia		Armenia
	Brazil		Azerbaijan
	Chile		Belarus
	Colombia		Georgia
	Costa Rica		Kazakhstan
	Dominican Republic		Kyrgyz Republic
	Ecuador		Macedonia
	El Salvador		Moldova
	Guatemala		Montenegro
	Honduras		Russia
	Mexico		Serbia
	Nicaragua		Tajikistan
	Panama		Turkey
	Paraguay		Ukraine
	Peru		
Uruguay			
Venezuela			
SSA	Central African Republic	EAP	Cambodia
	Madagascar		Indonesia
	Malawi		Malaysia
	Mali		Mongolia
	Namibia		Philippines
	Niger	Thailand	
	Nigeria	Vietnam, Democratic Republic of	
	Rwanda		
	Senegal	SA	Bangladesh
	South Africa		Bhutan
	Togo		India
	Uganda	Pakistan	
	Zambia	Sri Lanka	
		MENA	Egypt
			Iran
	Jordan		
	Tunisia		

Table A2: Descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min	Max
Real GDP_pc	739	4,220	3,529	284.4	14,688
GDP growth (annual %)	739	4.908	4.247	-36.7	34.5
Total natural resources rents (% of GDP)	738	7.327	7.84	0.071	44.56
Population, total	741	3.92E+07	5.44E+07	613,353	2.58E+08
Trade (% of GDP)	738	78.54	34.05	21.45	210.4
Number of credit unions and credit cooperatives	373	4,193	18,916	1	111,797
Depositors with commercial banks	455	1.75E+07	2.73E+07	37,746	1.32E+08
Loan accounts with commercial banks	450	1.46E+07	4.91E+07	1,400	4.67E+08
Outstanding deposits with commercial banks	836	1.61E+08	8.53E+08	170.7	1.10E+10
Number of commercial bank branches/ 100,000 adults	822	13.68	11.66	0.289	71.21
Number of depositors with commercial banks/ 1,000 adults	455	568.5	531.8	7.513	3,380
Number of loan accounts with commercial banks/ 1,000 adults	450	323.9	359.3	0.529	2,909
Automated teller machines (ATMs) /100,000 adults	785	30.95	29.05	0	185.3
GINI index	473	41.33	8.939	24	64.8
Agriculture value added / GDP	852	13.3	8.996	2.089	43.4
Tax-to-GDP ratio	781	15.76	5.674	3.133	36.33
Direct taxes	680	5.208	2.717	0.0182	17.44
Taxes on income	731	5.403	2.8	0	18.01
Taxes on property	601	0.307	0.399	0	1.847
Indirect taxes	749	10.57	4.233	1.619	26.54
Total taxes on goods and services	761	8.319	3.77	0.422	18.91
Value-added tax (VAT)	675	5.326	2.98	0	14.68
Taxes on trade	748	1.749	1.759	0.169	13.13
Debt-to-GDP ratio	711	41.36	22.25	3.89	160.5
Polity2 index	739	4.453	5.202	-10	10
Inflation	742	7.314	7.802	-3.109	121.7
Gross fixed capital formation / GDP	858	25.12	8.071	6.812	69.53
Net ODA received_pc	852	45.88	48.88	-49.54	304.6
Human capital index	616	2.359	0.55	1.137	3.357
Financial markets efficiency	671	0.188	0.283	0	1
Private consumption_pc	430	2,434	1,709	311.5	8,406
Remittances/ GDP	840	5.93	7.208	0.0106	44.13
Unemployment	476	8.049	6.181	0.914	46.03
Tax revenue diversification index	381	0.622	0.276	0.155	1.539
Private credit bureau	374	17.631	17.063	0	54

Table A3: Sources and definitions of data

Variables	Definition	Sources
ATMs / 100,000 adults	Automated teller machines (ATMs) (per 100,000 adults)	IMF, FAS 2019 Dataset
Bank branches/ 100,000 adults	Number of commercial bank branches per 100,000 adults	
Loan accounts/ 1000 adults	Number of loan accounts with commercial banks per 1,000 adults	
Depositors/ 1000 adults	Number of depositors with commercial banks per 1,000 adults adults	
Credit unions and cooperatives	Number of credit unions and credit cooperatives	
Outstanding deposits	Outstanding deposits with commercial banks	
Depositors with CBs	Depositors with commercial banks	
Loan accounts with CBs	Loan accounts with commercial banks	
Tax-to-GDP ratio	Non-resource tax excluding social contributions	ICTD/UNU-WIDER, GRD 2019
Indirect taxes-to-GDP ratio	Indirect taxes excluding social contributions and resource revenue	
Direct taxes-to-GDP ratio	Direct taxes excluding social contributions and resource revenue	
Taxes on income-to-GDP ratio	Taxes on income, profits, and capital gains	
Taxes on goods-to-GDP ratio	Taxes on goods and services, Total	
Value-added tax-to-GDP	Value-added tax	
Tax on property-to-GDP	Taxes on property	
Taxes on trade-to-GDP	Taxes on international trade and transactions	
Tax diversification index	Theil index-based tax revenue diversification index	Compaore <i>et al.</i> (2020)
Real GDP_pc	Real GDP_pc	World Bank's World Development Indicators (WDI, 2019)
Resources rent	Total natural resources rents (% of GDP)	
Trade openness	Sum of total imports and exports (% of GDP)	
Agriculture VA	Agriculture value added (% of GDP)	
Population	Total population	
Aid_pc	Net official development assistance received per capita (current US\$)	
Remittances	Personal remittances, received (% of GDP)	
Public investment	Gross fixed capital formation (% of GDP)	
GDP growth	GDP growth (annual %)	
GINI index	GINI index	
Private consumption_pc	Households and NPISHs Final consumption expenditure per capita	
Unemployment	Unemployment with advanced education (% of total labor force with advanced education)	
Inflation	Inflation, average consumer prices	World Economic Outlook (WEO, 2019)
Financial sector efficiency	Financial markets efficiency	IMF's Financial Development Index Database
Public debt-to-GDP ratio	Debt to GDP ratio	Ali Abbas <i>et al.</i> (2010)
Human capital index	Human capital index	Penn World Table (PWT9.1)
Polity2 index	Polity2 index	Polity4 Project
Private credit bureau	Number of years of operation of credit bureau	Coulibaly and Yogo (2020)

Table A4. Robustness check: using alternative financial inclusion variables

	<i>Dependent variable: Total non-resource tax-to-GDP ratio</i>					
	[1]	[2]	[3]	[4]	[5]	[6]
Dep. variable (lagged)	0.98195*** (0.026)	0.91934*** (0.034)	0.99999*** (0.065)	0.97207*** (0.039)	0.96158*** (0.035)	0.94884*** (0.047)
Bank branches /100,000 adults (Log)	0.39697* (0.216)					
Loan accounts with CBs / 1,000 adults		0.00085** (0.000)				
Depositors with CBs/ 1,000 adults (Log)			0.39437*** (0.130)			
Credit unions and credit cooperatives (Log)				0.17861* (0.094)		
Outstanding deposits with CBs (Log)					0.22248** (0.104)	
Depositors with CBs (Log)						0.26622** (0.130)
Loan accounts with CBs (Log)						
Control variables	YES	YES	YES	YES	YES	YES
Observations	585	320	341	282	591	341
Countries	61	38	37	31	61	37
AR(1) <i>p-value</i>	0.000	0.003	0.000	0.000	0.000	0.000
AR(2) <i>p-value</i>	0.938	0.277	0.933	0.345	0.726	0.971
Hansen OID (<i>p-value</i>)	0.145	0.276	0.308	0.257	0.113	0.334
Nb. of instruments	34	37	27	30	33	32
<i>Year FE</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>

*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in brackets. Note: Constant terms, as well as vector X variables are included but not reported for space purpose. Complete tables are available upon request.

Table A5. Robustness check: using alternative tax data source

	<i>Dependent variable: Non-resource tax-to-GDP ratio</i>					
	[1] Tot. Tax	[2] Indirect	[3] Direct	[4] Income	[5] Gds & Serv.	[6] VAT
Dep. variable (lagged)	0.93419*** (0.054)	0.94664*** (0.019)	0.72407*** (0.048)	0.55052*** (0.073)	0.83982*** (0.043)	0.84138*** (0.026)
ATMs /100,000 adults (Log)	0.57344*** (0.221)	0.03778 (0.038)	0.09862*** (0.035)	0.17310** (0.084)	0.03613 (0.069)	0.09707*** (0.038)
Real GDP_pc	0.00051** (0.000)	0.00041*** (0.000)	0.00004 (0.000)	-0.00007 (0.000)	0.00025*** (0.000)	0.00030*** (0.000)
Squared real GDP_pc (Log)	-0.22008** (0.096)	-0.09573*** (0.022)	-0.01931 (0.035)	0.01345 (0.048)	-0.06755** (0.033)	-0.09786*** (0.017)
Total natural resources rents (Log)	0.24967 (0.155)	-0.08976* (0.047)	0.32007*** (0.073)	0.41351*** (0.117)	-0.18594** (0.079)	0.04066 (0.038)
Trade openness	2.61191*** (0.993)	-0.01759 (0.279)	1.55332*** (0.511)	1.70134*** (0.383)	-0.01693 (0.375)	0.98626*** (0.274)
Agriculture value added	-0.15356* (0.082)	-0.01422 (0.014)	-0.06269** (0.029)	-0.05246 (0.051)	-0.03955 (0.034)	-0.05176*** (0.018)
Polity2 index	0.05684** (0.029)	0.01377 (0.009)	0.02256 (0.022)	0.00114 (0.021)	0.01302 (0.014)	0.03541*** (0.013)
Constant	1.90469 (7.966)	5.33194*** (1.773)	-3.96212 (3.056)	-5.64911 (3.996)	5.34860** (2.613)	1.76028 (1.610)
Observations	431	321	320	431	421	411
Countries	52	37	37	52	52	51
AR(1) <i>p-value</i>	0.000	0.003	0.006	0.009	0.000	0.023
AR(2) <i>p-value</i>	0.234	0.213	0.858	0.241	0.370	0.581
Hansen OID (<i>p-value</i>)	0.121	0.290	0.249	0.766	0.176	0.377
Nb. of instruments	27	32	26	27	27	36
<i>Year FE</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>

*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level, respectively. Standard errors are reported in brackets.