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Article

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Central Bank Review (CBR)

Provided in Cooperation with:

Central Bank of The Republic of Turkey, Ankara

Suggested Citation: Oz-Yalaman, Gamze (2019) : Financial inclusion and tax revenue, Central Bank Review (CBR), ISSN 1303-0701, Elsevier, Amsterdam, Vol. 19, Iss. 3, pp. 107-113, <https://doi.org/10.1016/j.cbrev.2019.08.004>

This Version is available at:

<https://hdl.handle.net/10419/217337>

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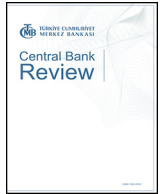
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Financial inclusion and tax revenue[☆]

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ARTICLE INFO

Article history:

Received 4 April 2019

Received in revised form

15 August 2019

Accepted 23 August 2019

Available online 7 September 2019

JEL classification:

G21

H24

O16

Keywords:

Financial inclusion

Tax revenue

Panel data

Global finindex

ABSTRACT

Financial inclusion might bring huge amounts of income into the global economy, which creates different opportunities and challenges for countries. As people become more financially included and their incomes grow over time, this might in turn increase their tax contributions to the government. Thus, this paper seeks an answer to the primary question of whether the changes in tax revenue is associated with the change in financial inclusion for countries around the world by using an extensive dataset of 137 countries over the years between 2011 and 2017. For this, the paper uses the Global Finindex database and panel data methodology. The empirical findings show that there is a significant and positive relationship between financial inclusion and tax revenues and it is one of determinants of tax revenues. The results are robust in terms of different sources of taxation such as corporate tax revenue, income tax revenue and direct tax revenue. Policy-makers around the world could take advantage of this significant opportunity in order to raise tax revenues by considering ways of increasing financial inclusion.

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1. Introduction

Financial inclusion, which can be defined as the situation in which “individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way”, is one of the important policy tools to increase welfare, reduce poverty and enhance macroeconomic stability (Beck et al., 2004; Beck et al., 2007; Chibba, 2009; Hannig and Jansen, 2010; Cull et al., 2012; Morgan and Pontines, 2014; Park and Mercado, Jr., 2015; Kim, 2016).

There are almost 1.2 billion adults financially included in the world since 2011. However, almost 1.7 billion people are financially excluded. The World Bank have committed to helping people gain access to financial services and become involved in the formal economy by the year 2020 (see detail in UFA2020 Overview).

Interestingly, until 2011, there had been no consistent sets of data available to help us understand the financial lives of people all

around the world. The release of the Global Financial Inclusion database, known as the Global Finindex, changed all that. This new database enabled many empirical studies to be done on financial inclusion. According to the Global Finindex database, there are 1.2 billion adults who have obtained an account since 2011, including 515 million since 2014. Between 2014 and 2017, the share of adults with an account in a financial institution or through a mobile money service rose globally from 62 percent to 69 percent.¹ This rapid increase in financial inclusion might bring huge amounts of income into the global economy, which creates different opportunities and challenges for which countries will need to prepare (Sarma, 2008; Cull et al., 2012; Blackburn et al., 2012; Bose et al., 2012; Capasso and Jappelli, 2013; Park and Mercado, Jr., 2015; Maherali, 2017). As people become more financially included and their income grows over time, this might in turn increase their tax contributions to the government. In this regard, as the world moves towards financial inclusion, it is important for policy-makers to take advantage of this situation to raise their tax revenues.

Tax collection and tax law enforcement are difficult to enforce in both developed and developing economies. Thus, increasing tax revenue is a major concern for policy-makers. Policy-makers can

[☆] The author wishes to thank Prof. Dr. Murat Tasdemir, and two anonymous referees for their helpful comments on earlier version of the article.

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Peer review under responsibility of the Central Bank of the Republic of Turkey.

¹ <https://globalfinindex.worldbank.org/>.

directly increase revenues by taking in to account determinant of tax revenue. There are many papers in the literature that focus on different determinants of tax revenue (Ghura, 1998; Piancastelli, 2001; Eltony, 2002; Mertens, 2003; Gupta, 2007; Bird et al., 2014; Mahdavi, 2008; Chaudhry and Munir, 2010; Clist and Morrissey, 2011; Le et al., 2012; Addison and Levin, 2012; Dioda, 2012; Karagöz, 2013; Castro and Camarillo, 2014).

Unlike the common literature on the subject, the present paper investigates whether the change in the tax revenue is associated with the change in financial inclusion for countries around the world. In other words, the present paper is an attempt to introduce a new determinant of tax revenue as financial inclusion, which has not been previously tested in the literature by using the Global Findex in particular.

The Global Findex has published datasets in 2011, 2014 and 2017 with over 100 indicators, covering 140 countries and interviews with 150,000 people. This regularly published datasets enable us to test the connection between financial inclusion and tax revenue by using panel data methodology, which has not been done before. Panel data methodology is essential because the model is based on comprehensive observations derived from both “time-series” and “cross-sectional” data, which enhances degree of freedom and ensures estimation of a more robust model with fewer problems (Baltagi, 1995).

There is only one study in the literature investigating the relationship between financial inclusion and tax revenue by using the Global Findex (Maherali, 2017). Maherali (2017) uses various global datasets and develops a methodology to forecast the individual tax revenue that governments gain by the year 2020 due to financial inclusion. The present paper, on the other hand, extends the database by including 2017 data and investigates a possible direct association between financial inclusion and tax revenue by using panel data methodology. Furthermore, it is clear that the source of taxation is an important aspect of tax revenues. The present paper uses three different categories of tax revenue in addition to total tax revenue such as corporate tax revenue, income tax revenue, and direct tax revenue.

The results suggest a significant and positive relationship between financial inclusion and tax revenues. The results are robust in terms different sources of taxation such as corporate tax revenue, income tax revenue and direct tax revenue. Policy-makers around the world could take an advantage of this significant opportunity by considering ways of increasing financial inclusion in order to raise tax revenues. The rest of the paper is organized as follows: the next part of this study discusses the existing literature, the third part describes the dataset and presents the methodology and estimation results, and the last part concludes.

2. Literature review

Financial inclusion, also known as a financial exclusion, is one of the main policy tools to increase welfare, reduce poverty and enhance macroeconomic stability (Beck et al., 2004; Andrianaivo and Kpodar, 2011; Sarma and Pais, 2011; Han and Melecky, 2013; Kim, 2016). There are various definitions of financial inclusion. For example, Sinclair (2001) defines financial exclusion as “the inability to access necessary financial services in an appropriate form”. Sarma (2008) defines financial inclusion as “the ease of access, availability and usage of the formal financial system by all members of the economy”.

Financial inclusion is considered as one of the important policy tools for policy-makers. For example, Mohan (2006) points that, for India, financial inclusion could help accelerate economic growth and lead to financial development. Andrianaivo and Kpodar (2011) investigate the relationship between

information and communication technologies (ICT) and economic growth in African countries over the years 1988–2007. They state that financial inclusion has a central role in this relationship and part of the positive effect of ICT on growth comes from higher financial inclusion. Lenka and Sharma (2017) show a significant and positive effect of financial inclusion on economic growth in both the long- and short-run periods in India. In terms of macroeconomic and financial stability, Hannig and Jansen (2010) examine the relationship between financial stability and financial inclusion. They show that financial inclusion enhances the financial stability. Cull, Demirguc-Kunt and Lyman (2012) state that financial inclusion may make the household and small business sector healthier and thus contribute to an enhanced macroeconomic stability. Also, Han and Melecky (2013) and Morgan and Pontines (2014) suggest that increase in financial inclusion contributes to financial stability. Chibba (2009) points out that financial inclusion is critical in the fight against poverty. Similarly, Park and Mercado, Jr. (2015) analyze the relationship between financial inclusion and poverty in 37 developing Asian countries. Their findings show that financial inclusion decreases poverty and contributes income equality.

It is clear that an increase in financial inclusion might bring many advantages with huge amounts of income into the global economy, which creates different opportunities and challenges for countries. One opportunity is that policy-makers can use financial inclusion as a policy tool to increase their tax revenues.

There are many papers in the literature investigating the determinants of tax revenue. Empirical findings show that GDP per capita, agricultural sector, industrial sector, capital inflow, openness, political stability, corruption, inflation, accountability, and mortality are some of the primary determinants of tax revenue (Tanzi and Davoodi, 1997; Ghura, 1998; Piancastelli, 2001; Gupta, 2007; Bird et al., 2008; Chaudhry and Munir, 2010; Dioda, 2012; Karagöz, 2013; Castro and Camarillo, 2014). Interestingly, there are currently no papers in the literature testing whether financial inclusion is one of the determinants of tax revenue. There are a limited number of empirical studies examining the relationship between financial development² and tax revenue, but there is not any specific paper focusing on the effect of financial inclusion on tax revenue. For example, Taha et al. (2013) analyze the relationship between direct tax revenue and financial system activity in Malaysia. They find that there is a unidirectional causality from stock market to direct tax revenue. In addition, this relationship is more profound in the short term. Ilievski (2015) focuses on the relationship between stock market and tax revenue for 96 countries over the years 1990–2008 and states that stock markets positively affect tax revenue. Akçay, Sağbaş and Demirtaş (2016) investigate the relationship between financial development and tax revenue in Turkey during the period from 2006 to 2014. The paper divides financial development into two parts as banking and non-banking financial development. The results show that banking and non-banking financial development cause direct tax revenue in the long-run, while the banking financial development causes

² Financial development and financial inclusion are two different concepts and they both provide micro and macro benefits. For example, there is much evidence in the literature showing that financial development has a significant and positive effect on economic growth but a significant and negative effect on poverty (Patrick, 1966; Greenwood and Jovanovic, 1990; De Gregorio and Guidotti, 1995; Jalilian and Kirkpatrick, 2002; Honohan, 2004; Jeanneney and Kpodar, 2011). Recently, Bose et al. (2012) show that an improvement in the development of the banking sector is associated with a smaller shadow economy. Blackburn, Bose and Capasso (2012) find that lower level of financial development increases tax evasion and the size of the shadow economy. In addition, Capasso and Jappelli (2013) state that higher local financial development is associated with a smaller shadow economy.

direct tax revenue in the short-run. In Pakistan, Akram (2016) seeks an answer to the question of how financial sector activities affect tax revenue and concludes that financial sector can help promote tax revenues. Bayar, Şaşmaz and Öztürk (2017) analyze the association between financial development and tax revenue in OECD countries. Their findings support the effects of financial developments on tax revenue. Bayar and Karamelikli (2017) investigate the relationship between financial development and tax revenue in Turkey during the period from 2006 to 2016. They use banking sector development and stock market development as a financial development variable. The results indicate that there is a nonlinear positive relationship between financial development and tax revenue.

Ajide and Bankefa (2017) investigate the effect of financial system on tax revenue in Nigeria over the years 1981–2014. They find that stock market development and banking development have a significant and positive effect on tax revenue. Moreover, they use the number of bank branches as a proxy for financial inclusion and find a significant and negative relationship. Also, Ebi (2018) indicates that financial development promotes tax revenue in Nigeria. Nnyanzi, Bbale and Sendi (2018) analyze the association between financial development and tax revenue in East African countries during the period from 1990 to 2014. They show that financial development positively affects tax revenue.

According to review of the literature, there is only one study in the literature investigating the relationship between financial inclusion and tax revenue by using the Global Findex (Maherali, 2017). Maherali (2017) uses various global datasets and develops a methodology to forecast the individual tax revenue that governments gain by the year 2020 due to financial inclusion. According to Maherali (2017), financial inclusion affects the income tax revenue.

To fill the gap in the literature, the present paper seeks an answer to the primary question of whether the changes in tax revenue are associated with the change in financial inclusion for countries around the world. Therefore, the paper uses the Global Findex database and panel data methodology to test whether financial inclusion is one of determinants of tax revenue.

2.1. Data, model and empirical findings

The paper uses panel data that consists of both cross-sectional and time series information to test for any endogenous interaction between tax revenue³ and financial inclusion.⁴ The data covers 137⁵ countries for the years 2011, 2014 and 2017, for which the data is available.⁶ Dataset is a panel with significant time gaps, but it is dictated by the availability of the dependent variable. Table 1 displays the definitions and sources of the variables.

Table 2 and Table 3 present the descriptive statistics for all the variables with respect to three variations: the overall, within and between types of variation. Overall variation represents variation over years and across countries. Between variation represents variation between countries, and within variation represents variation within each country (over years).

For example, according to Table 2, the mean values for tr and $fi_{account}$ are 18.34416 and 54.70575, respectively. The minimum values are 0.6452 for tr and 0.4049 for $fi_{account}$, while the maximum values are 48.4590 for tr and 100 for $fi_{account}$. For tr , the standard deviations of the overall, between and within variations are 7.821, 7.533 and 1.772, respectively. This means that we have more between variation from one country to the next than within variation, which means the variation of countries over years. For $fi_{account}$, the standard deviation of the overall, between and within variations are 30.414, 29.227, and 8.207, respectively. This means that we have more between variations from one country to the next than within variation.

The following panel data model is used to test whether the changes in tax revenue is associated with the change in financial inclusion for countries around the world.

$$tr = \beta_0 + B_1 fi_{it} + \sum_{k=2}^{14} \beta_k CV_{it} + \beta_{15} dum_{2011} + \beta_{16} dum_{2014} + \varepsilon_{it} \quad (1)$$

The above model is estimated by using 4 different tax revenues as a dependent variable: tr , dtr , $indv$, and $corp$. Moreover, we use bank account (% age 15+) as a proxy for financial inclusion. However, for robustness check, we change proxy from bank account (% age 15+) to credit card ownership (% age 15+), where $\sum \beta_k CV_{it} = B_2 gdp_{it} + B_3 open_{it} + B_4 agri_{it} + B_5 ind_{it} + B_6 psi_{it} + B_7 inf_{it} + B_8 debt_{it} + B_9 itr_{it} + B_{10} ctr_{it} + B_{11} cf_{it} + B_{12} account_{it} + B_{13} corr_{it} + B_{14} tariff_{it}$.

Time-fixed effects are included in the analysis as a dummy variable to check common shocks in the data as dum_{2011} for 2011 and dum_{2014} for 2014. The dummy variables get a value of 1 for the years 2011 and 2014, respectively.

In the regressions, we use the fixed effects estimator with country effects as indicated by the F test for econometric specifications (Wooldridge, 2010). For the F test, we add country specific means as an explanatory variable to the RHS and estimate the model by OLS, and finally test the joint significance of these means using an F-test. The null is rejected for all cases, and finally we use FE estimator. Moreover, we report heteroscedasticity-consistent estimates.

Because the dependent variable in the regressions is a ratio such as tax revenues/GDP, we use logistic transformation of dependent variables to fit a model (see Baum, 2008).⁷

³ Tax contributions to governments come in various forms such as income taxes, business taxes, and tariffs from trade. The paper uses total tax revenue, direct tax revenue, individual income tax revenue and corporate tax revenue. Indirect taxes will be outside the scope of this paper.

⁴ There are several indicators used to measure financial inclusion such as the number of bank accounts (per 1,000 adults), the number of bank branches (per 1 million people), the number of ATMs (per 1 million people), the amount of bank credit, and the amount of bank deposits (see Sarma, 2008). Moreover, there are two different indexes available in the literature for measurement of financial inclusion: the World Bank's Global Findex and Sarma's (2008) index of financial inclusion.

⁵ The countries covered in this study are Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Comoros, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Djibouti, Dominican Republic, Ecuador, El Salvador, Estonia, Ethiopia, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Haiti, Honduras, Hungary, India, Indonesia, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyz Republic, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Rwanda, Saudi Arabia, Senegal, Serbia, Sierra Leone, Singapore, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Vietnam, Zambia, Zimbabwe.

⁶ The Global Findex has published datasets for only the years 2011, 2014 and 2017.

⁷ We apply `stata invlogit()` function to perform logit transformation on the data. We also check another alternative is to estimate using `glm` with family(binomial), link(logit), and robust; this is the method proposed by Papke and Wooldridge (1996). Our results are consistent, so we report logistic transformation of dependent variables. For brevity, we only report the logistic transformation of dependent variables' results.

Table 1
Variables and sources.

Variable	Definition	Source
tr	Tax revenue (% of GDP)	World Bank Database
dtr	Taxes on income, profits and capital gains (% of GDP)	World Bank Database
indv	Individual income tax revenue (% of GDP)	International Monetary Fund Database
corp	Corporate income tax revenue (% of GDP)	International Monetary Fund Database
fi _{account}	Bank account (% age 15+)	Global Findex Database, World Bank
fi _{credit}	Credit card ownership (% age 15+)	Global Findex Database, World Bank
gdpper	GDP per capita	World Bank Database
openness	Trade (% of GDP)	World Bank Database
agri	Agriculture (% of GDP)	World Bank Database
ind	Industry (% of GDP)	World Bank Database
ps	Political Stability and Absence of Violence	World Bank Database
account	Voice and Accountability	World Bank Database
inf	Inflation, consumer prices (annual %)	World Bank Database
tarif	Tariff rate, applied, simple mean, all products (%)	World Bank Database
corr	Corruption	Transparency International, Corruption Perception Index
debt	Central government debt, total (% of GDP)	World Bank Database
cf	Foreign direct investment + portfolio investment	World Bank Database
itr	Income Tax Rate	Heritage Foundation, Index of Economic Freedom
ctr	Corporate Tax Rate	International Monetary Fund Database

Table 2
Descriptive statistics for financial inclusions and dependent variables.

	Variation	Mean	Std. Dev.	Min	Max
tr	overall	18.34416	7.820966	0.645224	48.459
	between		7.533253	0.856554	46.35833
	within		1.772851	4.60749	32.46637
dtr	overall	7.570908	4.548546	0.084677	31.737
	between		4.424409	0.174508	29.40433
	within		0.72492	3.989816	10.84191
indv	overall	4.535974	4.037086	0.137336	26.349
	between		3.826874	0.18	24.70467
	within		0.426834	1.927492	6.180308
corp	overall	3.063087	2.070986	0.055982	17.17031
	between		2.068141	0.055982	16.1645
	within		0.608256	−0.12466	6.489753
fi _{account}	overall	54.70575	30.41425	0.404912	100
	between		29.22715	7.171871	99.88472
	within		8.207146	30.85959	81.39065
fi _{credit}	overall	18.11808	20.21984	0	82.58482
	between		19.81535	0	77.32878
	within		3.1519	4.879484	40.64232

Table 3
Descriptive statistics: Control variables.

	Variation	Mean	Std. Dev.	Min	Max
gdpper	overall	14592.1	20156.79	213.4056	107865.3
	between		20168.2	230.4408	106761
	within		1240.456	5034.361	29561.22
open	overall	90.26701	53.26383	19.45884	423.9863
	between		52.36543	24.16894	376.5758
	within		9.913318	37.14083	137.6775
agri	overall	11.43171	11.8006	0.026471	60.28355
	between		11.71396	0.031999	55.55651
	within		1.344299	3.700704	19.07899
ind	overall	27.35589	11.91895	2.310512	74.61211
	between		11.62324	9.546995	66.63946
	within		2.829276	14.16998	43.20478
ps	overall	−0.13927	0.915081	−2.81004	1.593475
	between		0.89411	−2.56463	1.479378
	within		0.204546	−0.83433	1.116071
inf	overall	4.789521	5.475684	−3.7043	53.2287
	between		4.55181	−1.01173	27.49945
	within		3.34491	−14.972	32.22486
debt	overall	55.37277	37.20198	4.774519	194.4281
	between		35.85545	4.774519	186.1945
	within		6.782734	30.53818	80.20736
itr	overall	28.92774	13.1737	0	60
	between		13.07974	0	60
	within		1.816924	8.927737	38.92774
ctr	overall	23.8519	8.941622	0	50
	between		8.843112	0	50
	within		1.460628	13.51856	29.18523
cf	overall	0.058017	0.090272	−0.26189	0.869467
	between		0.066031	−0.06057	0.368819
	within		0.066954	−0.28019	0.558665
account	overall	−0.02638	0.943835	−2.25916	1.692057
	between		0.941331	−2.19455	1.667501
	within		0.095093	−0.41547	0.344093
corr	overall	−0.04038	1.013552	−1.59093	2.404429
	between		1.009755	−1.48596	2.281654
	within		0.1125	−0.47167	0.360267
tarif	overall	6.289596	4.476375	0.19	19.27
	between		4.710884	0.223333	19.095
	within		0.920721	1.869596	13.3796

Once tax revenue has been regressed on the 14 sets of control variables in the model, we expect to observe a positive relationship between tax revenue and financial inclusion based on several reasons. First, financial inclusion may make the household and small business sector healthier, which helps macroeconomic stability and economic growth. From a different perspective, as individuals become more financially included, their incomes grow over time. Second, empirical evidence shows that financial inclusion helps decrease poverty and increase income equality. Third, there is some evidence suggesting a negative relationship between financial development and shadow economy, and tax evasion (Beck et al., 2004; Sarma, 2008; Blackburn et al., 2012; Park and Mercado, Jr., 2015; Lenka and Sharma, 2017; Maherali, 2017).

The literature provides us with 14 different sets of control variables for determinants of tax revenue. For example, GDP per capita is added as a proxy for country's development level that is expected to have a positive sign. The increase in a country's development level increases the share of formal economy (Gupta, 2007; Castro and Camarillo, 2014). Openness measures trade volume, but its expected sign is controversial. Openness might have a positive sign because increase in trade volume increases economic growth and,

therefore, increases tax revenue. On the other hand, openness might have a negative sign because the increase in trade volume decreases the tax revenue on import and export (Le et al., 2012; Castro and Camarillo, 2014). Furthermore, the paper adds another variable in the model as a control variable: capital inflow, which is

the sum of FDI and portfolio investment. This is because capital inflows are one of the main determinants of growth in emerging markets as growth rate contributes to tax revenue. The expected sign of capital inflow can be both positive and negative in the literature. Capital inflows can have a positive effect on economic growth, and therefore it might have a positive effect on tax revenue as well. On the other hand, negative effects can appear when countries impose tax incentives to attract capital flows (Mahmood and Chaudhary, 2013; Castro and Camarillo, 2014). Agriculture is another important determinant of tax revenue whose expected sign is negative considering the challenge of taxing agricultural sector. Contrary to agricultural sector, industry might have positive effect on tax revenue (Piancastelli, 2001; Gupta, 2007; Clist and Morrissey, 2011; Karagöz, 2013; Castro and Camarillo, 2014). There are institutional factors such as political stability, accountability and corruption and it is expected that political stability and accountability have positive effects on tax revenue while corruption has negative effects. Countries with high political stability and accountability and a low level of corruption indicate a better state of world. This results in better public service delivery, better perception of government and less tax evasion or shadow economy

(Tanzi and Davoodi, 1997; Gupta, 2007; Bird et al., 2008; Chaudhry and Munir, 2010; Dioda, 2012). The paper uses inflation as a proxy for macroeconomic stability. The increase in inflation rates might decrease the taxpayers' income. Therefore, the expected effect of inflation on tax revenue is negative (Tanzi, 1989; Ghura, 1998). Government debt is another important determinant of tax revenue. The high level of debt of a government causes an increase in tax revenues as it has to be financed. On the other hand, higher level of external government debt can lower tax base. Thus, the expected sign of government debt might be positive or negative (Tanzi, 1989; Ghura, 1998; Gupta, 2007; Chaudhry and Munir, 2010). In order to confirm the impact of tax policy in countries, corporate tax rates, income tax rates and also tariff rate are included as control variables. Therefore, the Laffer curve should be taken into consideration. In other words, an increase in tax rate increases the tax revenue up to a certain tax rate and then decreases it. Moreover, an increase in tax rates in corporate tax and in some income types subject to income tax may cause taxpayers to evade taxation or informality and consequently decrease the tax base. On the other hand, an increase in tax rates may also mean more public goods and services for which taxpayers are willing to pay. Thus, the expected

Table 4
Regression Results (Dependent variable: Tax revenue (% of GDP)).

DV: tr	$\hat{\alpha}_{\text{account}}$	$\hat{\alpha}_{\text{credit}}$
	Logit-Transformation	Logit-Transformation
fi	0.000239*** (6.15)	0.000305*** (12.86)
gdpper	-0.000000303*** (-4.41)	-0.000000380*** (-8.80)
open	-0.00000535 (-1.36)	0.0000199*** (8.85)
agri	-0.000704*** (-7.49)	-0.000836*** (-9.31)
ind	-0.000318 (-1.78)	-0.000360 (-1.97)
ps	0.00364*** (13.09)	0.00383*** (4.84)
inf	0.000745*** (15.12)	0.000669*** (17.05)
debt	-0.000119*** (-74.63)	-0.000106*** (-334.17)
itr	0.0000481*** (4.65)	0.0000458 (1.41)
ctr	-0.000227*** (-5.43)	-0.000115*** (-7.63)
cf	-0.0151 (-1.54)	-0.00819 (-0.93)
account	0.0146*** (31.29)	0.0114*** (7.52)
corr	-0.00650*** (-9.06)	-0.00508*** (-8.85)
tariff	-0.000308 (-1.42)	-0.0000814 (-0.31)
dum ₂₀₁₁	0.559*** (103.69)	0.572*** (96.40)
dum ₂₀₁₄	0.563*** (110.34)	0.00406*** (75.09)
constant	0.57*** (276.68)	0.564*** (128.70)
R ²	0.78	0.81
F-Test for fixed effects p-value	21.47	26.84
	0.0002	0.0001
Heteroscedasticity Test	0.0000	0.0000

Heteroscedasticity Test represents Modified Wald test for groupwise heteroskedasticity. The null hypothesis is rejected for all the models. Therefore, we take heteroscedasticity into account and make White (1980, 1986) correction to increase efficiency for all the models and we report heteroscedasticity-consistent estimates. In our regression, we use the fixed effects estimator as indicated by F test for econometric specifications t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 5
Regression Results (Dependent variable: Taxes on income, profits and capital gains (% of GDP)).

DV: dtr	$\hat{\alpha}_{\text{account}}$	$\hat{\alpha}_{\text{credit}}$
	Logit-Transformation	Logit-Transformation
fi	0.0000648*** (4.16)	0.000120** (3.19)
gdpper	4.76e-08 (2.00)	3.45e-09 (0.12)
open	-0.0000127*** (-32.05)	-0.00000211 (-0.95)
agri	-0.0000734 (-1.44)	-0.0000918 (-1.45)
ind	0.0000802 (1.45)	0.0000819 (1.20)
ps	0.00272** (3.05)	0.00290*** (6.56)
inf	0.000208*** (4.05)	0.000176*** (12.18)
debt	-0.0000689*** (-28.07)	-0.0000672*** (-15.24)
itr	0.000139*** (8.51)	0.000136*** (25.88)
ctr	0.000241*** (8.81)	0.000281*** (6.35)
cf	-0.00300 (-0.51)	-0.000944 (-0.16)
account	0.00339*** (18.55)	0.00250*** (5.45)
corr	-0.000214 (-0.37)	-0.000120 (-0.40)
tariff	-0.000529* (-2.71)	-0.000459* (-2.30)
dum ₂₀₁₁	0.509*** (254.24)	-0.001 (-1.81)
dum ₂₀₁₄	0.510*** (305.19)	0.00102*** (4.71)
constant	0.502*** (60.35)	0.509*** (193.29)
R ²	0.73	0.76
F-Test for fixed effects p-value	16.32	18.42
	0.0004	0.0003
Heteroscedasticity Test	0.0000	0.0000

Heteroscedasticity Test represents Modified Wald test for groupwise heteroskedasticity. The null hypothesis is rejected for all the models. Therefore, we take heteroscedasticity into account and make White (1980, 1986) correction to increase efficiency for all the models and we report heteroscedasticity-consistent estimates. In our regression, we use the fixed effects estimator as indicated by F test for econometric specifications t statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

sign of tax rate can be positive or negative (Gupta, 2007; Dioda, 2012).

Tables 4–7 show the fixed effect estimation results. For all the regression models, financial inclusion has a significant and positive effect on tax revenue. The results are consistent in terms of various types of tax revenue and financial inclusion proxy. Regarding the control variables, consistent with the existence literature *gdpper*, *accountability*, *political stability* and *income tax rate* have significant and positive effects on tax revenue. On the other hand, *openness*, *agriculture*, *government debt*, *corruption* and *tariff rate* have a significant and negative effect on tax revenue. The sign of control variables mostly remain the same for the models using different dependent variables. Interestingly, *inflation* has significant and positive effects on tax revenue. However, *industry* has significant and negative effects on tax revenue, which is different from expectation. We can clearly conclude that the sign of control variables are mostly consistent with the previous literature.

When credit card ownership is used as a proxy for financial inclusion, the results support the positive relationship between financial inclusion and tax revenue. Moreover, in terms of the sign of the control variables, the results remain the same in most of the models.

Table 6
Regression Results (Dependent variable: Individual income tax revenue (% of GDP)).

DV: inc	$\hat{\alpha}_{\text{account}}$	$\hat{\alpha}_{\text{credit}}$
	Logit-Transformation	Logit-Transformation
<i>fi</i>	0.000105*** (3.86)	0.0000861* (2.43)
<i>gdpper</i>	7.86e-08* (2.67)	5.97e-08 (1.87)
<i>open</i>	-0.0000150*** (-10.55)	-0.00000952*** (-90.09)
<i>agri</i>	0.0000426 (1.23)	-0.0000539* (-2.33)
<i>ind</i>	-0.000183*** (-3.70)	-0.000194*** (-3.99)
<i>ps</i>	0.00166* (2.67)	0.00166*** (8.64)
<i>inf</i>	0.000251*** (6.75)	0.000233*** (310.67)
<i>debt</i>	-0.0000412*** (-8.31)	-0.0000340*** (-6.59)
<i>itr</i>	0.000185*** (6.16)	0.000190*** (32.35)
<i>cf</i>	-0.00222 (-0.48)	-0.0000207 (-0.00)
<i>account</i>	0.00382*** (18.57)	0.00260** (3.58)
<i>corr</i>	-0.00182** (-3.01)	-0.000560 (-1.11)
<i>tariff</i>	-0.000519*** (-4.22)	-0.000387** (-3.32)
<i>dum₂₀₁₁</i>	0.507*** (395.15)	0.510*** (809.19)
<i>dum₂₀₁₄</i>	0.507*** (448.55)	0.511*** (898.66)
<i>constant</i>	0.506*** (539.51)	0.515*** (4348.93)
<i>R</i> ²	0.71	0.84
F-Test for fixed effects p-value	31.89	63.44
Heteroscedasticity Test	0.0000	0.0003

Heteroscedasticity Test represents Modified Wald test for groupwise heteroskedasticity. The null hypothesis is rejected for all the models. Therefore, we take heteroscedasticity into account and make White (1980, 1986) correction to increase efficiency for all the models and we report heteroscedasticity-consistent estimates. In our regression, we use the fixed effects estimator as indicated by F test for econometric specifications *t* statistics in parentheses, **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

Table 7
Regression Results (Dependent variable: Corporate income tax revenue (% of GDP)).

DV: corp	$\hat{\alpha}_{\text{account}}$	$\hat{\alpha}_{\text{credit}}$
	Logit-Transformation	Logit-Transformation
<i>fi</i>	0.000109** (3.58)	0.000119** (3.20)
<i>gdpper</i>	0.000000113* (2.55)	7.76e-08 (2.03)
<i>open</i>	-0.0000144*** (-25.87)	-0.00000518*** (-5.14)
<i>agri</i>	0.000109* (2.61)	0.0000290 (0.70)
<i>ind</i>	-0.000156** (-3.28)	-0.000161** (-3.06)
<i>ps</i>	0.000629 (1.62)	0.000713*** (23.08)
<i>inf</i>	0.000243*** (8.08)	0.000215*** (15.68)
<i>debt</i>	-0.0000408*** (-12.82)	-0.0000347*** (-10.25)
<i>ctr</i>	0.000169*** (8.32)	0.000198*** (3.98)
<i>cf</i>	-0.000258 (-0.05)	0.00242 (0.46)
<i>account</i>	0.00456*** (87.94)	0.00321** (3.26)
<i>corr</i>	-0.00115* (-2.50)	-0.000131 (-0.30)
<i>tariff</i>	-0.000569** (-3.53)	-0.000448* (-2.70)
<i>dum₂₀₁₁</i>	0.506*** (212.93)	0.508*** (263.05)
<i>dum₂₀₁₄</i>	0.506*** (223.41)	0.509*** (267.01)
<i>constant</i>	0.514*** (239.36)	0.515*** (497.84)
<i>R</i> ²	0.67	0.86
F-Test for fixed effects p-value	29.64	76.98
Heteroscedasticity Test	0.0001	0.0000

Heteroscedasticity Test represents Modified Wald test for groupwise heteroskedasticity. The null hypothesis is rejected for all the models. Therefore, we take heteroscedasticity into account and make White (1980, 1986) correction to increase efficiency for all the models and we report heteroscedasticity-consistent estimates. In our regression, we use the fixed effects estimator as indicated by F test for econometric specifications *t* statistics in parentheses, **p* < 0.05, ***p* < 0.01, ****p* < 0.001.

3. Conclusions

Exploring dynamics of financial inclusion is a major concern for policy-makers. Financial inclusion can be a key tool to increase welfare, reduce poverty and enhance macroeconomic stability. On the other hand, there are many papers in the literature on the determinants of tax revenue. However, these studies do not consider financial inclusion as a determinant of tax revenue. Thus, to fill the gap in the literature, the current paper investigates whether the changes in tax revenue is associated with the change in financial inclusion for countries around the world by using extensive dataset from a panel of 137 countries over the years between 2011 and 2017. The present paper provides some strong empirical evidence for a significant and positive relationship between tax revenue and financial inclusion. The results are robust with respect to the effects of different categories of tax revenues and different tips of financial inclusion proxy. As people become more financially included and their income grows over time, this will in turn increase their tax contributions to the government. It is vital for policy-makers to understand how the increased financial inclusion of their citizens will affect their tax revenues.

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