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Article

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Full Length Article

The impact of financial inclusion on tax revenue in EMEA countries: A threshold regression approach

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Abstract

Many countries are still struggling to increase the collection of domestic revenue. Financial inclusion has the potential to raise massive income in any country. As people become more financially integrated and their income rises over time, their tax payments to the government may rise as well. Thus, using a wide dataset of 45 countries in Europe, the Middle East, and Africa from 2008 to 2019, this paper employs a panel threshold regression model to address the key issue of whether changes in tax revenue are linked to changes in financial inclusion. We use a generalized method of moments model to test the robustness of the results. The main findings show a nonlinear relationship between financial inclusion and tax revenue, which indicates that, at low levels, financial inclusion has a negative impact on tax collection, whereas, at the high level, financial inclusion has a positive and significant impact on tax revenue.

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1. Introduction

A government's primary sources of income are tax and nontax revenue from economic activities. In most countries all over the world, in recent years, privatization has reduced the proportion of the public sector in the economy. As a result, governments now rely heavily on tax collection as a main source of funding. Because of privatization, tax revenue has become increasingly vital source of income for the government in order to be able pay for key public services. Policy makers in both developing and developed countries are concerned about tax revenue volatility, as it may cause fluctuations in public spending and public investment, all of which can hinder economic growth. Economic growth, in turn, is critical in determining the size of a country's tax base and, as a result, performance of public services, especially tax collection. At the

same time, governments in both developed and developing countries must increase government revenue in order to finance economic development plans.

As a result, estimating tax revenue and identifying influential drivers of tax revenue have become highly important issues in economic policy formation and are vital for policy makers in designing more effective economic policies. Most governments have begun to take a variety of measures to minimize the presence of the shadow economy and, as a result, increase total tax collection. From this perspective, financial sector improvements have the potential to enhance tax collection by increasing economic activity and diminishing the shadow economy.

Financial development can affect direct tax income in a variety of ways. First, economic growth increases the number of taxable economic activities, which expands direct tax income. Second, economic expansion generates wealth and increases demand for products and services, resulting in new investment. As a result, the income tax base expands, which leads to an increase in direct tax collection. Third, both

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financial development and economic growth can act as deterrents to the functioning of the shadow economy. Finally, financial progress can directly raise tax collection by facilitating tax monitoring and collection (Akçay et al., 2016; Bose & Capasso, 2012).

Access to formal financial services enables people to conduct financial transactions more effectively and safely, as well as enabling poor people to pursue education and business. Inclusion in the financial system benefits society as a whole. Shifting the form of payment from cash to financial accounts makes payments from governments or corporations to people—and from individuals to governments or businesses—more efficient and transparent (Demirgüç-Kunt et al., 2017). Furthermore, inclusion in the formal financial system enhances the likelihood of facilitating investment and expanding business possibilities, resulting in greater tax income to support economic growth (Al-Own & Bani-Khalid, 2021).

Individuals become active or inactive consumers of financial services when they participate in the official financial system. Even after major attempts are made to bring the excluded population into the official financial system, these individuals might choose to become passive consumers of financial products over time. They create official accounts but decline to get credit or debit cards, do not make deposits to their formal accounts, and do not engage in financial activities through their formal accounts. They only use their official accounts to receive money and not to send money to others. These inactive users pose a new dilemma for policy makers because their financial inactivity holds down the number of financial transactions, income from financial institutions, and tax revenue, all of which have an economic impact (Ozili, 2020).

Because few studies investigate the relationship between financial inclusion and tax revenue, this study fills a gap in the literature by examining the impact of financial inclusion on tax revenue using a threshold regression model to allow for the nonlinearity of this relationship. Using panel data on 45 countries in Europe, the Middle East, and Africa (EMEA) over the period 2008 to 2019, this paper examines the impact of financial inclusion on tax revenue. The rest of this paper consists of five sections following the introduction. Section 2 includes a review of the existing literature. Section 3 highlights the key dimensions of financial inclusion. Section 4 illustrates data sources, and descriptions, principal component analysis, as well as the model description. Section 5 summarizes the main results of the model and the robustness check of the results. Finally, Section 6 presents our conclusions.

2. Literature review

Many studies have been conducted on the factors that affect tax revenue. They show that the gross domestic product (GDP) per capita, inflation, capital inflows, trade openness, manufacturing, and agriculture are the main determinants of tax revenue (Anastassiou & Dritsaki, 2005; Andrejovská & Puliková, 2018; Balıkcıoğlu et al., 2016; Basirat et al., 2014; Bayar & Ozturk, 2018; Chaudhry & Munir, 2010; Drummond et al., 2011; Egwakhe et al., 2018; Gupta, 2007; Ihuarulam

et al., 2021; Kobyagda, 2019; Mahmood & Chaudhary, 2013; Muibi & Sinbo, 2013; Nguyen-Phuong et al., 2022; Prowd & Kollie, 2021; Simbachawene, 2018; Tsaurai, 2021).

Additionally, several studies study the relationship between financial development and tax revenue. Using different samples and different indicators of financial development, they find that financial development has a favorable impact on tax revenue. Akram (2016) finds that the number of bank branches and market capitalization have a favorable and considerable impact on tax collection in the long term. Credit to the private sector and tax revenue have a bidirectional relationship, but government borrowing has no impact on tax revenue. In the short run, the number of bank branches and market capitalization are the only factors that affect tax revenue. Akçay et al. (2016) indicate that financial development plays a significant role in direct tax revenue collection in Turkey.

Ahamed (2016) shows that financial development is important in reducing corporate tax evasion and hence increasing tax revenue. Koyuncu and Yilmaz (2016) reveal that the penetration of information and communication technology leads to greater tax revenue. Okon (2018) realizes that in Nigeria the access and the depth of financial institution development are key determinants in tax collection, followed by the depth and the stability of financial markets. Using a generalized methods of moments (GMM) model, Nnyanzi et al. (2018) find that financial development in general, as well as financial institutions and financial markets, have a significant impact on tax revenue. The depth of financial institutions is important for tax revenue, as a 1 percent change in the depth of financial institutions is projected to provide a 0.266 percent change in tax revenue. The studies have also found no significant evidence in support of financial market access or financial institution efficiency. Aim and Lompo (2021) find that more developed financial sectors have a positive and considerable impact on the government's capacity to generate tax revenue. They believe that the positive impact of financial development on non-resource tax revenue collection, which is tax revenue from all sources except natural resources, is substantial only when public debt is low. The findings show that tax collection in emerging countries is heavily reliant on financial institutions and financial markets.

Moreover, a few studies examine the relationship between financial inclusion and tax revenue. Al-Own and Bani-Khalid (2021) explore the link between financial inclusion and tax revenue using a sample of 28 European countries from the Global Findex database from 2011 to 2017. Data on having a bank account (percentage of those over age 15) and credit card ownership (percentage of those over age 15) are used as indicators for financial inclusion. Their study shows that financial inclusion has a considerable positive influence on four key measures of tax revenue: tax revenue, tax on income, individual income tax revenue, and corporate income tax revenue. As a result, their research reveals that financial inclusion can be seen as a determinant of tax revenue, hence, regulations to promote it should be implemented.

Oleschak (2021) contributes to the debate on the causes and consequences of financial inclusion by examining the

relationship between technology and monetary and fiscal policy. According to this study, inefficient technologies that result in high costs of access to financial institutions, as well as an inefficient tax regime, can reduce the level of financial inclusion and tax revenue and raise the level of inflation. Lowering the cost of access and having a better tax system have the potential to boost financial inclusion, increase governments' capacity to tax directly and reduce the stress of doing this through raising inflation.

3. Financial inclusion and its dimensions

The main objective of financial inclusion is to include “unbanked” individuals in the official financial system so that they can use the banking system to save money, make payments, and transfer funds. Financial inclusion refers to the provision of affordable financial services to disadvantaged and low-income people, as opposed to financial exclusion, which happens when those services are neither available nor affordable. Four dimensions can be used to evaluate financial inclusion (Hannig & Jansen, 2011; Kumari, 2021), as follows.

The first dimension is financial access. The capacity to use accessible financial services and products from formal institutions is referred to as access (Aduda & Kalunda, 2012). Counting the number of open accounts across financial institutions and determining the share of the population that has an account is a simple proxy for access (Hannig & Jansen, 2011).

The second dimension is quality, which refers to the suitability of a financial service or product based on a customer's lifestyle requirements. It also refers to a consumer's perception of the goods or services to which they now have access, as expressed in their attitudes and views. As a result, the quality metric can be used to assess the type and depth of the relationship between the financial service provider and the customer, as well as the options offered and the customer's awareness of those options and their consequences.

Usage is the third dimension of financial inclusion. Usage concerns the durability and depth of financial services and products used, in addition to the fundamental acceptance of banking services. As a result, evaluating usage necessitates additional information regarding the consistency, frequency, and duration of use over time. Data acquired from a demand-side survey is crucial for measuring usage because it reflects the user's perspective.

Finally, the fourth dimension is “impact.” Impact refers to the measurement of changes in customers' lives that might be linked to the use of a financial instrument or service (Aduda & Kalunda, 2012; Hannig & Jansen, 2011).

4. Data and methodology

4.1. Data

This study makes use of cross-country estimates and macro data from 45 EMEA countries between 2008 and 2019. The availability and reliability of data were the primary factors we

used in deciding which countries and periods to include. The dependent variable used in this study is tax revenue. Tax revenue is reported as a proportion of GDP. The data on tax revenue (% of GDP) were collected from the World Databank Indicators. Furthermore, the financial inclusion index is included as an independent variable. This index has several dimensions. The dataset of the main dimensions included in the calculation of financial inclusion are deposit accounts with commercial banks, outstanding deposits with commercial banks, outstanding loans from commercial banks, the number of commercial bank branches per 100,000 adults, and the number of automated teller machines (ATMs) per 100,000 adults collected from the Financial Access Survey database of the International Monetary Fund (IMF). Tax revenue has many other determinants. So, factors such as GDP per capita expressed in constant 2010 US dollars, trade openness, population, and the inflation rate calculated using consumer prices (annual %) are included in the model. Data for these variables were obtained from the World Databank Indicators.

4.2. Principal component analysis

Financial inclusion is a broad concept that is difficult to quantify in a clear manner. This variable, however, is assumed to be affected by the interplay of several significant factors. Static principal component analysis (PCA) cannot be used for data with a time-dependent structure, as it tries to linearly approximate complicated nonlinear relationships between variables (Melnikov et al., 2016). As a result, we use dynamic principal component analysis (DPCA) to generate a financial inclusion indicator. To the best of our knowledge, a dynamic principal component is used in many fields, such as chemical processes and air pollution, but not financial inclusion.

The objective of PCA is to minimize the dimensionality of a dataset while preserving as much “variability” as possible. It is a statistical technique that involves converting a sample of observations of potentially correlated variables into a number of values of linearly uncorrelated variables via orthogonal transformation. PCA can also be used to reduce multidimensional data to fewer dimensions while maintaining most of the data. It includes eigenvectors, covariance, and standard deviation (Abdel Fattah, 2017; Jolliffe & Cadima, 2016; Karamizadeh et al., 2013).

Let the variables included in the calculation of financial inclusion be $X_1, X_2, \dots, X_p$. The principal components are algebraically defined as a specific linear combination of the p -random variables $X_1, X_2, \dots, X_p$. The principal components are exclusively determined by the covariance matrix or the correlation matrix of the variables. The main goal is to use an orthogonal transformation to translate the p -variables to another set of variables, resulting in a group of independent vectors (Khatwani & Aanand, 2017).

DPCA was first developed by Federici and Mazzitelli (2009) as an extension to static PCA. It integrates a cross-section analysis using PCA with the time-series dimension of the data with a linear regression model using a descriptive approach. Then, the sample includes three different

dimensions: units, variables, and time. The data arrays have three dimensions (unit i , variable j , and time t). DPCA decomposes the variance and covariance matrix S as follows (Federici & Mazzitelli, 2009; Wang et al., 2020):

$$S = S_T^* + S_T \quad (1)$$

where S_T^* is the average dispersion matrix within variability, and S_T is the average dispersion matrix within time.

This analysis employs five indicators for financial inclusion: deposit accounts with commercial banks (X_1), outstanding deposits with commercial banks (X_2), outstanding loans from commercial banks (X_3), the number of outstanding deposits with commercial bank branches per 100,000 adults (X_4), and the number of ATMs per 100,000 adults (X_5).

$$fin = \alpha_1(X_1) + \alpha_2(X_2) + \alpha_3(X_3) + \alpha_4(X_4) + \alpha_5(X_5) + \varepsilon \quad (2)$$

Table 1 demonstrates that the eigenvalue of the first four components is larger than one, whereas that of the fifth component is less than one. In constructing the index of financial inclusion, we include only components with eigenvalues larger than 1. The first four components (C1, C2, C3, and C4) comprise 99.6 percent of the cumulative variance.

The first four major components are employed to determine financial inclusion. The equations for the first four components can be written using the eigenvectors for the DPCA in Table 2 as follows:

$$C1 = -0.39289 (X_1) + 0.576993(X_2) + 0.743057 (X_3) - 0.09306 (X_4) + 0.143184 (X_5) \quad (3)$$

$$C2 = 0.586757 (X_1) - 0.11542 (X_2) - 0.12761 (X_3) + 0.694788 (X_4) + 0.378656 (X_5) \quad (4)$$

$$C3 = -0.68679 (X_1) + 0.180037 (X_2) + 0.220719 (X_3) + 0.667873 (X_4) - 0.031831 (X_5) \quad (5)$$

$$C4 = -0.313023 (X_1) - 0.041165 (X_2) - 0.05206 (X_3) - 0.250077 (X_4) + 0.913823 (X_5) \quad (6)$$

Therefore, the four dynamic principal components can be combined in Equations (3)–(6) to determine financial inclusion as follows:

Table 1
Dynamic principal component analysis.

Number	Value	Explained variability	Cumulative variability
1	5.0705271	0.32197942	0.32197942
2	4.6622281	0.29605236	0.61803178
3	3.9294939	0.2495236	0.86755537
4	2.0255047	0.12861992	0.9961753
5	0.0602314	0.0038247	1

Table 2
Eigenvectors for DPCA analysis.

Variable	e1	e2	e3	e4	e5
X_1	0.39289	0.586757	-0.686879	-0.3130233	0.012075
X_2	0.576993	-0.11542	0.1800373	-0.0411651	0.787178
X_3	0.743057	-0.12761	0.2207193	-0.0520586	-0.61657
X_4	-0.09306	0.694788	0.6678726	-0.2500771	0.004252
X_5	0.143184	0.378656	-0.031831	0.9138234	0.005635

$$Fin = -0.02026 (X_1) + 0.600448 (X_2) + 0.784106 (X_3) + 1.019527 (X_4) + 1.403832 (X_5) \quad (7)$$

Equation (7) shows that, on average, the number of ATMs per 100,000 adults and the number of commercial bank branches per 100,000 adults are the most important factors in explaining financial inclusion. Financial inclusion can be determined by substituting the actual data for the five dimensions in equation (7).

4.3. Model

Previous studies focus mainly on various determinants of tax revenue, but few studies show the linkage between financial inclusion and tax revenue. Financial inclusion might be one of the determinants that affect tax revenue. Financial inclusion affects tax revenue in two different ways. First, financial inclusion helps to increase the tax base by integrating more people into the formal economy. Electronic payment can be used as a tool to achieve this objective. As the income of financially integrated people rises over time, their tax payment will increase as well. Second, financial inclusion helps to increase economic growth, which in turn encourages people to invest more, and hence tax revenue will increase (Mahera, 2017).

This study examines the nonlinear relationship between financial inclusion and tax revenue. The assumption here is that financial inclusion has one or more threshold values. We use the panel threshold regression approach to shed light on the nonmonotonic influence of financial inclusiveness on tax revenue. It is best described as a strategy for investigating the nonlinear relationship between two or more variables. Consequently, this model is applicable to real-world conditions and can yield more relevant results. The main advantage of using a threshold regression is that it enables a sample to be divided into groups so that the role of the threshold variable can be tailored to determine whether countries are above or below the threshold parameter (Ouyang et al., 2019).

The empirical model that shows the linkages between financial inclusion and tax revenue can be written as shown in Equation (8):

$$Taxrev_i = \beta_0 + \beta_1 Fin_i + \beta_2 Z_i + \varepsilon_i \quad (8)$$

where $Taxrev$ = tax revenue as a percentage of GDP, Fin = index of financial inclusion, Z_i = vector of control variables that affect tax revenue. i = country, $i = 1, 2, \dots, n$.

ε_i = error term, with a mean of zero and finite variance (Chu et al., 2019).

The first step should be to test the threshold effect hypothesis, or nonlinearity, as follows:

$$H_0: \beta_1 = \beta_2$$

$$H_1: \beta_1 \neq \beta_2$$

where β_s are vector parameters. The null hypothesis postulates that the relationship is linear, whereas the alternative hypothesis suggests that the relationship is nonlinear. If the null hypothesis is rejected, the model will be a two-mode nonlinear threshold regression.

The empirical model used is based on Hansen (1999, 2000) and can be written as in Equation (9).

$$Taxrev_{it} = a_0 + \beta_1 Fin_{it} I(Fin_{it} \leq \gamma) + \beta_2 Fin_{it} I(Fin_{it} > \gamma) + \delta_i Z_{it} + \varepsilon_{it} \quad (9)$$

where Fin is the level of financial inclusion and is the variable used to divide the sample into regimes or groups, and γ is the unknown threshold parameter. This modeling technique allows the importance of financial inclusion to vary, depending on whether the countries are above or below a certain level of γ .

$$Z_i = \{\text{open, GDPcap, pop, inf}\}$$

where Open is trade openness; GDPcap is GDP per capita; Pop is the population, and Inf is the inflation rate.

Based on previous studies, the impact of trade openness on tax revenue can be positive or negative. Openness may lead to an increase in economic growth and, as a result, tax income. But openness can have a negative impact, as tax revenue received from imports and exports will decrease. Also, GDP per capita can have a positive or negative impact on tax revenue, as found by Ayenew (2016), Baiardi et al. (2017), and Veisi (2017). With respect to the total population, tax revenue will also increase as the total number of people increases (Korwatanasakul et al., 2021). Finally, the inflation rate is expected to have a negative impact on tax revenue (Oz-Yalaman, 2019).

5. Empirical results and discussion

5.1. Examining the validity of threshold effects

The first step to be performed before the threshold regression is conducted is testing for the threshold effect. The bootstrap approach was used 300 times to evaluate the existence of threshold effects, yielding a respectable test p -value of 0.00 for a single threshold and 0.0167 for a double threshold, as shown in Table 3, which is less than the significance limit of 5 percent. This implies that the null hypothesis of a linear relationship is rejected. As a result, the model includes two values of the financial inclusion threshold effect, as illustrated in Table 3.

Table 3
Threshold effect test and estimators.

Threshold	RSS	MSE	Fstat	Prob
Single	1161.0478	2.199	64.41	0.000
Double	10.754779	2.0369	42.01	0.0167
Threshold estimator				
Model	Threshold	Lower	Upper	
Th-1	20.4407	20.303	20.4459	
Th-21	20.4407	20.0430	20.4459	
Th-22	23.4471	23.3382	23.4880	

5.2. Estimation results of the threshold regression model

Table 3 shows two levels of threshold regimes: 20.44 percent and 23.45 percent. According to the estimates in Table 4, financial inclusion has a negative and statistically significant impact on tax revenue at a threshold regime of less than 20.44 percent. When financial inclusion rises by 1 percent, tax revenue falls by 0.0036 percent. At a threshold regime between 20.44 percent and 23.45 percent, financial inclusion has a substantial beneficial effect on tax revenue. This means that when financial inclusion increases by 1 percent, tax revenue increases by 0.0089 percent. At a threshold level exceeding 23.45 percent, financial inclusion has a positive, significant impact on tax revenue, so when financial inclusion increases by 1 percent, tax revenue rises by 0.029 percent.

The results also show that trade openness has a positive, statistically significant impact on tax revenue, as it is an indicator of increased trade volume that boosts economic growth and, as a result, raises tax revenue. GDP per capita and the inflation rate have negative statistically significant impacts on tax revenue. Finally, the total population has a positive but insignificant impact on tax revenue.

5.3. Robustness checks

Chu et al. (2019), Abdulahi et al. (2019), and Thanh (2015) check for robustness using the generalized methods of moments. Similarly, we use dynamic GMM to test the robustness of the sensitivity of the panel threshold regression analysis results. This method is crucial if the cross-sectional data exceed the time-series data. The sample under consideration consists of 45 countries and a relatively small number of periods. The

Table 4
Results of the threshold regression model estimation.

Variable	Estimated coefficient	Probability $p > t$
Constant	16.63625	0.0000
GDPCAP	−0.0833592	0.014
OPEN	2.282503	0.001
INF	−0.0084259	0.014
POP	0.024817	0.575
Threshold estimates		
B ₀	−0.0036515	0.006
B ₁	0.0088508	0.000
B ₂	0.0389005	0.000
Observations	540	
Number of cross sections	45	

Table 5
Results of dynamic Arellano–Bond system GMM.

Variable	GMM
TAX(-1)	0.127677 ^a (0.010922)
GDPCAP	-0.296427 ^a (0.078331)
OPEN	1.515474 ^a (0.348042)
INF	-0.006449 (0.004409)
FIN	-0.033639 ^a (0.010810)
FIN ²	0.000132 ^a (0.0000035)
POP	0.727203 ^a (0.107052)
J-statistic	38.37481
Prob (J-statistic)	0.452496
Instrument rank	45
AR (2')	0.8992

Notes: the standard errors are in parentheses. The value of AR (2) is the *p*-value.

^a Significance at the 1% level.

lagged values of all variables are used as instrumental variables. To account for the presence of a U-shaped (nonlinear) relationship, the squared term of financial inclusion is incorporated into the specification of GMM as follows:

$$\text{Taxrev}_i = \alpha_0 + \alpha_1 \text{Fin}_i + \alpha_2 \text{open}_i + \alpha_3 \text{pop}_i + \alpha_4 \text{GDPcap}_i + \alpha_5 \text{inf}_i + \alpha_6 \text{Fin}_i^2 + \varepsilon_i \quad (10)$$

The results of the GMM model in Table 5 indicate that the estimated signs of all variables are consistent with those of the threshold model. The results also reveal that financial inclusion is a strong driver of tax revenue. These results show that financial inclusion and tax revenue have a U-shaped relationship. Moreover, according to the Sargan test, the instruments are valid, and the model is accurately specified the results of the AR serial correlation diagnostic test demonstrate the absence of serial correlation.

6. Conclusion

Economists study the main determinants of tax revenue, one of which is financial inclusion. Policy makers explore the dynamics of financial inclusion, which can be a powerful instrument for improving well-being, reducing poverty, and supporting macroeconomic stability. This study investigates the impact of financial inclusion on tax revenue in a sample of 45 EMEA countries over the period 2008 to 2019 using a threshold regression model. The robustness of the results is demonstrated through the use of a dynamic GMM model.

The primary findings of this study can be divided into three categories. First, the link between financial inclusion and tax revenue has a threshold impact. However, we reach a fresh conclusion about the nonmonotonic or nonlinear links between financial inclusion and tax revenue. Second, financial inclusion has a negative impact on tax revenue at the low-regime threshold level. Third, financial inclusion has a beneficial and considerable impact on tax revenue, especially at the high-regime threshold level.

As people become more financially connected and earn more money, they can make larger tax payments to the government. It is critical for policy makers to comprehend the impact of growing financial inclusion on tax revenue. This can be accomplished by paying more attention to this issue and

making financial inclusion a priority in policy makers' policy design. Fintech is a crucial component of financial inclusion, and policy makers in any country should extend its use to financial access. Furthermore, policy makers must prioritize measures for increasing financial inclusion with its strong tax revenue-enhancing effects in mind.

In conclusion, this paper can help decision-makers to find the ideal level of financial inclusion, particularly in countries where financial inclusion is a priority. As a result, they can set policies to target the appropriate degree of financial inclusion to get the optimum tax revenue.

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