

# Impact of Financial Inclusion and Digital Financial Services on Tax Revenue in South Asian Countries

-  Nisar Ahmad<sup>1</sup>  
 Bilal Nafees<sup>2</sup>  
 Muhammad Azeem<sup>3</sup>  
 Hasan Kamran<sup>4</sup>  
 Faisal Mumtaz<sup>5</sup>

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## Abstract

This study examined the influence of financial inclusion and digital financial services on tax revenue creation in developing South Asian countries. Regression analysis was performed on a panel data set comprising six developing economies from 1991 to 2021 to achieve this objective. The WDI database of the World Bank was used to obtain data on tax revenues, financial inclusion, digital financial services, and control variables such as inflation, unemployment, and personal remittances. The results of the random effect estimator indicate that financial inclusion and digital financial services significantly impact tax revenues in emerging economies of South Asia. Financial inclusion has been observed to adversely impact tax revenues, while digital financial services have been found to contribute to tax revenues positively. The study's findings indicate that authorities should prioritize the supply of digital financial services to enhance tax collections. Additionally, it is necessary to ascertain the factors that influence the provision of digital financial services in developing economies. The causes behind the adverse impact of financial inclusion on tax collections should be thoroughly examined.

**Keywords:** Tax Revenues, Financial Inclusion, Digital Financial Services

## 1 Introduction

<sup>1</sup>Associate Professor, Hailey College of Commerce, University of the Punjab, Lahore, Pakistan.

<sup>2</sup>Assistant Professor, Division of Management and Administrative Science, UE Business School, Lower Mall Campus, University of Education, Lahore, Pakistan.

<sup>3</sup>Department of Management Sciences, University of Central Punjab, Gujranwala Campus

<sup>4</sup>Finance Executive at GCC Solution, Cayan Business Center, Dubai, United Arab Emirates

**Corresponding author:** [nisar@hcc.edu.pk](mailto:nisar@hcc.edu.pk)

<sup>5</sup>Research Scholar/MPhil in Economics at the University of Education, Lahore



Policymakers, academics, and practitioners value digital financial services and tax income (Gupta et al., [2018](#); Tanzi, [2001](#)). Numerous studies have linked financial inclusion to economic growth and poverty reduction. Financial inclusion, digital financial services (DFS), and tax revenues have yet to be extensively studied (Musgrave, [1973](#)). Community members must pay the government. Taxation is the main way the government raises money to provide basic services (Nyaga, [2016](#); Besley, [2014](#); Bird & Gendron, [2009](#)). Tax revenue is essential to socioeconomic development worldwide (Allayarov & Rakhimov, [2022](#)). Sustainable economic growth requires good fiscal management (Oladipupo & Oladipo, [2022](#)). Beck et al. ([2007](#)) claim that financial inclusion boosts economic growth. Economic growth is higher in countries with increased financial inclusion. Tax income collection is essential for an inclusive and strong state, according to Apeti and Edoh, ([2023](#)).

Keen ([2010](#)), Bird ([2005](#)) and Shah ([1994](#)) have investigated how emerging countries struggle to raise tax revenue, which slows their progress. A large informal economy, financial illiteracy, and widespread poverty make tax collection and compliance problematic in these nations (Bird, [2011](#); Torgler, [2012](#); Laffer, [2004](#)). Gupta ([2015](#)), Torgler ([2005](#)) and Reynolds & Smolensky ([1977](#)) advocate tax systems that cover a nation's costs. The system should be fair, efficient, and manageable. These economies have a large informal sector that operates independently from official tax systems, resulting in revenue loss and lower tax returns (Alm et al., [2010](#)).

Despite recent economic growth, South Asia's tax system still needs to generate more revenue for government spending. Cullen and Gordon ([2007](#)) claim that direct, indirect, and property tax-collecting institutions need to perform better. Tax collection contributed to 11% of GDP in undeveloped nations and 20% in prosperous nations, according to Santoro ([2021](#)) and Prichard ([2022](#)). Sustainable development goals must require 15% of GDP in tax income to build a robust and resilient government. Therefore, a tax revenue imbalance causes major developmental issues (Cullen & Gordon, [2007](#)). Other academics (Akitoby, [2018](#); Basri et al., [2021](#); Santoro, [2021](#)) have stressed the role of tax income in nation-building.

Financial inclusion affects tax revenue, among other issues. Keen ([2004](#)), Gillis ([1992](#)), and Di John ([2011](#)) recommend taxing digital financial services in South Asian countries to boost tax revenue. Due to the expanding use of digital financial services, some countries have taxed all digital services (Bunn et al., [2020](#); Kelbesa, [2020](#)). DFS fees include digital currency transaction taxes in certain nations (Mullins et al., [2020](#)). Shrestha et al. ([2019](#)) say financial inclusion and digital financial services can enhance South Asian tax mobilization. Finance brings people and businesses into the formal economy, making tax collection easier. By boosting financial transaction transparency, digital financial services can help tax authorities find tax evaders. Mpfu and Mhlanga ([2022](#)) discovered that digital economic activity is booming in many countries.

Scholars must explore DFS taxation and revenue mobilization (Ahmed et al., [2021](#); Santoro, [2022](#)). Oz-Yalaman ([2019](#)) suggested that financial inclusion might enhance tax receipts in several countries. Encourage digital financial transactions and public banking in emerging nations to prevent tax evasion. Due to a lack of empirical data, we are examining how financial inclusion and digital transactions affect South Asian tax revenue mobilization. According to one study, financial inclusion and DFS can enhance tax collection in South Asia. Scholars can learn how financial inclusion and digital financial services raise taxes from the study. The paper suggests South Asian policymakers should promote financial inclusion and DFS to boost tax revenue.

Financial inclusion and the widespread use of digital financial services have become crucial factors in promoting economic growth in South Asian Countries. The Asian Development Bank (ADB) has conducted a recent study highlighting the significant impact of digital finance in promoting financial inclusion in Southeast Asian markets, including Indonesia, the Philippines, Cambodia, and Myanmar (ADB, [2023](#)). This study highlights the crucial importance of digital financial

solutions in increasing the availability of financial services and promoting economic growth, which directly impacts tax revenue streams in the region.

The correlation between financial inclusion and tax income has gained significant attention in scholarly and policy spheres. The relationship between financial inclusion and income potential has been extensively studied by Singh (2023) and Roy (2023). These studies emphasize the significant economic benefits that financial inclusion can bring to the global economy and the challenges and opportunities it presents for individual countries. Research conducted by Mishra (2024), Rahman and Khan (2023), and Hasan (2022) highlights the strong correlation between financial inclusion and tax revenue, supported by actual data from South Asian nations. This research highlights the significance of financial inclusion in enhancing the mobilization of tax income and its wider implications for sustainable economic growth in South Asian countries.

Moreover, the Macquarie Group (2023) provides valuable information about the specific impact of digital financial inclusion in Southeast Asia. The research conducted by the Macquarie Group highlights the role of digital services in promoting financial participation, which in turn can enhance tax collection by integrating individuals and enterprises into the formal economy. Studies conducted by Islam (2023) and Raza et al. (2023) highlight the capacity of digital financial services to not only increase tax revenue collection but also boost transparency in financial transactions, hence assisting tax authorities in the area.

Numerous studies have examined tax revenue determinants across economies, including fiscal policy and revenue production. Nuanced processes in emerging economies, particularly South Asian ones, are understudied. The present study explores South Asia's vibrant and diverse economies, unlike Raza et al. (2023), which focused on G7 tax revenue factors. Previous research has focused on GDP growth, inflation, and government expenditure (Smith, 2017), but this study examines how financial inclusion and digital financial services affect tax revenue generation in South Asia. This research recognizes South Asia's unique socio-economic terrain, high population densities, cultural variety, and variable economic development. This backdrop emphasizes the need for targeted fiscal policies that address traditional factors and harness inclusive financial ecosystems' transformative potential.

Financial inclusion has been shown to promote economic development and poverty reduction (Demirgüç-Kunt & Klapper, 2012), but its impact on tax revenue generation, particularly in South Asia, is understudied. This research seeks to bridge this vacuum and improve understanding of regional fiscal outcomes by merging finance, development economics, and public policy ideas. Digital financial services also change how financial transactions are conducted and documented, providing new opportunities to improve tax collection and fiscal transparency. However, the impact of these advances on tax revenue dynamics in emerging economies like South Asia is unclear. This study explains the relationship between digital financial services and tax revenue collection, highlighting potential synergies between technical advances and fiscal policy goals.

## 2 Review of Literature

Tax revenue mobilization is a significant economic topic debated internationally. Many developing nations need help generating enough tax revenue (Mpofu & Mhlanga, 2022; Jack & Suri, 2014). Numerous scientists have studied tax income mobilisation elements to address this issue. This section describes this research and their findings to determine how financial inclusions and DFS mobilize tax income. E-commerce (Automatic Teller Machines, Point-of-Sale, Online Purchasing, and GSM) affected national tax receipts in a 2013 study by Joe-Duke et al. (2015) and Crivelli (2016) reported that taxpayers can file taxes online using multiple platforms. This tax payment system update has simplified tax compliance. Financial inclusion and digital payment rates increased, which Maherali (2017) predicted would improve global income and tax revenues.

Digital finance and financial inclusion help financial service clients, suppliers, governments, and the economy, according to Ozili (2018). Digital financial tools support the economy by collecting taxes. Demircuc-Kunt et al. (2018) recommended moderate DFS taxation to avoid low-income exclusion from the financial industry and investigate usage, affordability, and distortions. Digitization has drawbacks, yet digital financial services boost informal economies in many countries. Gunawan and Suryaningsih (2018) found that ATM density and account ownership boost tax revenue. City financial inclusion and tax revenue mobilization are higher than rural. Oz-Yalaman (2019) discovered a positive correlation between financial inclusion and tax revenue, showing that financial inclusion may affect tax collections worldwide. Financial inclusion and tax revenue have a long-term beneficial relationship, according to Oz-Yalaman (2019). They showed that financial inclusion increases taxes.

The above demonstrates that digital financial services and financial inclusions greatly impact tax revenue mobilisation. Theoretically and empirically examined DFI's effects on TRM. According to research, DFI improves TRM by increasing tax compliance, reducing tax evasion, and widening the tax base. Tax system design, tax authority institutional capacity, and economic, and financial inclusion may affect DFI and TRM. Nguyen (2020) observed that account ownership and government trust affect tax revenue. Financial inclusion boosts tax revenue, notably in Sub-Saharan Africa (Asare & Donkor, 2020). Account ownership and ATM density increase tax revenue. The study found that financial inclusion raises indirect taxes more than direct taxes. Financial inclusion, digitisation, and tax revenue mobilisation affect advanced economies, according to Albulescu and Tamasila (2021). They testified that digitisation tempered the link between financial inclusion and tax revenue mobilisation, making financial inclusion more beneficial in digitalised nations. Koyama and Otsuka (2021) found that digital financial inclusion is essential for Japanese tax income. The study found that ATM installations and account ownership increase tax revenue. Unlike other digital banking technologies, Omodero and Okafor (2021) found that ATMs significantly impact tax income.

Many studies on how digital financial services (DFS) and technical advancements affect tax income, especially in developing nations, focus on financial inclusion. E-commerce platforms and GSM technologies have transformed tax compliance and revenue mobilization, according to Joe-Duke (2013). Alm (2015) and Crivelli (2016) emphasise the benefits and efficiency of online tax payment systems. According to Demircuc-Kunt and Klapper (2012), financial inclusion is essential to economic growth and government revenue. Maherali (2017) and Ozili (2018) emphasize the link between financial inclusion, digital finance, and tax income. They say widespread digital payment methods improve financial services and tax collection. However, Demircuc-Kunt et al. (2018) stress the significance of a careful DFS taxation framework to avoid the financial ecosystem marginalization of vulnerable people. This shows that government intervention is essential to promote financial inclusion fairly and increase tax revenue.

Al-Own & Khalid (2021) revealed that financial inclusion positively and significantly affects tax revenue mobilization at higher levels but negatively affects tax collection at lower levels. Kibritçioğlu (2021) states that financial inclusion long-term affects tax revenue collection. The study indicated that financial inclusion boosts tax revenue. Later, Raouf (2022) found similar results. His research examined how financial inclusion affects tax collection. He showed a curvilinear relationship between financial inclusion and taxes.

Omojola (2022) found that financial inclusion improved tax collection, while Munoz (2022) found that DFS taxation increased revenue. This would strain service suppliers, especially low-income generators. Thus, DFS taxation evidence needs to be included. Mader et al. (2022) found that digital financial inclusion mobilizes tax income more for SMEs. Later, Ofori and Asongu (2022) concluded that industrialisation and digital infrastructure are beneficial. They showed that financial inclusion increased tax revenue and stressed its importance for emerging nations. The

above proves that digital financial services and financial inclusions significantly impact tax revenue mobilization. Improved digital financial service infrastructure and taxpayer use of digital finance instruments boost tax compliance. This discussion suggests the following hypotheses.

**H1: There is a positive relationship between financial inclusions and tax revenue.**

**H2: There is a positive relationship between digital financial services and tax revenue.**

### 3 Data and Estimation Method

#### 3.1 Data

This research estimates how financial inclusion and digital financial services (DFS) affect tax revenue mobilization in developing South Asian nations such as Pakistan, India, Bangladesh, Afghanistan, Sri Lanka, and Nepal. The World Bank Development Indicator (WDI) database provided 2010–2021 data for these six nations to achieve this goal. Digital financial services and financial inclusion are independent variables. We measured tax revenue mobilization by comparing tax revenues to GDP. Financial inclusion and digital financial services were measured by financial institution or mobile-money-service provider account ownership (% of population ages 15+) and ATMs per 100,000 adults. The regression model included control variables including inflation, unemployment, and remittance, commonly used in tax revenue mobilization literature.

#### 3.2 Variables' Description and Data Sources

Here, TAXit is the response variable, and ACCOit and ATMit are the main predictor variables of the model whose effect will be studied on TRit, as per the study's discussion. INFit, UNEMit, and REMTit are the control variables. The data for the variables were retrieved from the WDI database reported on the World Bank website.

**Table 1:** Definition of variables

| Variable                  | Short Name | Definition and Units                                                                                                                                                                                                                                                                                                        | Source                       |
|---------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Tax revenue               | TR         | Taxes are mandatory payments made by individuals to the central government and are not refunded. Social contributions are not considered taxes. This study uses it in the (% of GDP).                                                                                                                                       | World Development Indicators |
| Account Ownership         | ACC        | The term "Account" refers to the proportion of survey participants who indicate that they either have an individual or joint account with a financial institution or have personally utilised a mobile money service in the last year, among those who are 15 or older. It is in this study (% of the population ages 15+). | World Development Indicators |
| Automated teller machines | ATMS       | Automated teller machines (ATMs) are computerised devices for electronic communication that allow individuals who have accounts in a bank to perform transactions in a public location (per 100,000 adults)                                                                                                                 | World Development Indicators |
| Inflation                 | INF        | Inflation is the yearly % increase in the cost of a basket of goods and services purchased by an average consumer, which may remain fixed or                                                                                                                                                                                | World Development Indicators |

|                      |      |                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |
|----------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Personal remittances | PER  | change periodically, such as every year. It is in (annual %).<br>Remittances consist of two elements: personal transfers and employee compensation. Personal transfers encompass all monetary or non-monetary transfers from residents to or from non-residents. Compensation of employees refers to the earnings of short-term workers. Who are employed in an economy where they are not residents as (% of GDP) | World Development Indicators |
| Unemployment         | UNEM | Unemployment pertains to the percentage of individuals in the workforce actively seeking employment but currently without a job. Here, it is measured as (% of the total labour force) (national estimate)                                                                                                                                                                                                         | World Development Indicators |

### 3.3 Estimation Model

The model built in this study is based on the existing literature on the impact of financial inclusion and digital financial services on tax revenue mobilization. For empirically testing the effect of financial inclusions and digital financial services along with control variables (inflation, unemployment, and remittances, the following regression model was specified.

$$TR_{it} = \beta_0 + \beta_1 ACCO_{it} + \beta_2 ATM_{it} + \beta_3 INF_{it} - \beta_4 UNEM_{it} + \beta_5 PER_{it} + \mu_{it} \quad (1)$$

In Eq. 1,  $\beta_0$  is the intercept or the value tax revenue that exists even if all other variables do not exist and  $\beta_1, \beta_2, \beta_3, \beta_4$ , and  $\beta_5$  are the slopes, and  $\mu_{it}$  represents the residual or the unexplained fluctuation in the response variable.

TR (Tax revenues), ACCO (Individual bank account used as a proxy for financial inclusion), ATM (Automatic teller machines used as a proxy for digital financial services), INF (Inflation), and UNEM (Unemployment). PER (personal remittances),  $\mu$  (random error term)

$$i \text{ country varies } 1 \dots N, t, \text{ year varies from } 1 \dots T$$

The positive relationship between the understudy variables estimated here can be verified from the theoretical evidence. “Financial inclusion positively and significantly affects tax revenue mobilisation, demonstrating that expansion in financial inclusion leads to an increase in tax revenue (Kibritçioğlu, 2021)”. “The adoption of digital finance tools has had a positive impact on the economy by making it easier for the government to collect tax revenue (Ozili, 2018)”

### 3.4 Estimator

The study estimates independent variable effects on the dependent variable using Ordinary Least Square regression (OLS). Using panel data, regression estimators can obtain the best linear unbiased estimate (BLUE). This data set changes with time and countries. This study used imbalanced panel data and several models and tests to evaluate marginal effect or stationarity. The model based on unbalanced panel data will be more efficient because it has more data. A test will compare fixed and random effects models. The general panel data equation is below:

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \epsilon_{it} \quad (2)$$

Cross-section data is used to estimate regression analysis parameters using the OLS method of least squares. This model features slopes, intercepts, and constant coefficients. Without country or temporal effects, you can pool the data and run an ordinary least squares regression model. Not all of these characteristics are statistically significant, but country or temporal effects are usually

present. Another name for this method is pooled regression. The general equation is below:

$$y_{it} = \alpha_i + \beta X_{it} + \epsilon_t \quad (3)$$

For  $i = 1, 2, 3 \dots N$  and  $t = 1, 2, 3 \dots, T$ .

Where N = No. Of Cross section, and T is the No. Of periods.

Pooled OLS coefficients are wasteful if country- and time-specific variances are considerable. The intercepts would change per cross-sectional unit, such as nation, but the slopes would remain constant. These models show significant disparities between countries even without temporal effects. Even though it is cross-section (group) specific and varies by country, the intercept may change with time. Fixed effects models, also called most miniature square dummy variable models, assume that the independent variables' values remain constant as the dependent variable changes relative to them. To avoid omitted variable bias. The fixed effect model uses person-specific intercepts for unobserved individual variability in panel data regression. This technique assumes individual-specific intercepts indicate stable unobserved heterogeneity over time. The fixed effect model estimates independent variable coefficients by evaluating individual variation across time, not variance. This technique works for time-invariant unobserved individual heterogeneity but not time-varying. Fixed effects assume intercepts explain individual changes. Intercepts can result from work, management, and incentive cultures. The fixed effects model is estimated using panel data and dummy variables to capture country intercept differences. This intercept was consistent across countries. The Least Squares Dummy Variable estimate method is LSDV. Fixed effect models use least squares, unlike standard effect models. The fixed effect regression equation is given below:

$$Y_{it} = \alpha_{it} + \beta X_{it} + \epsilon_{it} \quad (4)$$

N = the number of individuals or cross sections, and T = the number of periods.

This model shows autocorrelation without national disparities using time-lagged temporal effects. These model's residuals manage autocorrelation. The same factors apply nationwide. They may specialise or be regional. Technological advances or national limits may affect research variable change rates. Right-hand t-1 dummy variables represent t-year time effects. The country sets this model's intercepts and slopes. This model includes nation dummies and time-varying variables. Within-group fixed effects estimators estimate group average deviations (Davidson & MacKinnon, 1993).

The random effects model is a regression with a random constant, per Greene (2003). Consider the intercept a random outcome variable to account for ignorance or error. Mean + error = random result. The cross-sectional specific error term representing nation divergence must be uncorrelated with variable errors to emulate this. Cross-sectional time series regression uses random effect intercepts. Two-way random effects models use cross-section and time series error components (variance components). Avoid adding the error term to time series or cross-sectional (group) error. Orthogonality lets these components divide the general error into cross-sectional, temporal, and individual components.

$$e_{it} = v_i + e_t + \eta_t \quad (5)$$

Cross-sectional error  $v_i$ . Some panellists' observations alter. Add time-specific. All observations during t have this unusual inaccuracy. The third affects merely observation. SAS (1999) names these two-way random effects. Hildreth, Houck, and Swamy's random coefficient model parameters alter with cross-sectional units. Random intercept and slope parameters can fluctuate around common means with this method. A shared mean and each person's mean deviation error

term create random parameters. This model assumes no panel heteroscedasticity or autocorrelation to simplify the covariance matrix.

Unlike standard regression analysis, random-effects regression models assume cluster data are somewhat dependent—random-effects regression on clustered data. The random-effects assumption in this model says independent influences do not alter individual effects. Random-effects model error components explain firm intercept variation. Random-effect models eliminate heteroscedasticity.

This method is GLS (Error Component Model). Unlike typical and fixed effects, random effects models use generic least squares or probability maximisation. EVIEWS produces weighted and unweighted. LSDV Fixed Effects show model uncertainty. Residual variables help this random effect model solve problems. Time, individuals, or cross-sections may affect random-effects model residuals. This model assumes random intercepts for everyone. Thus, the random-effects model has two residuals: total cross-section and time series residual. Second, unit observations have random individual residuals. Regression Below is the random effect model equation

$$Y_{it} = \alpha + \beta'X_{it} + u_i + \epsilon_{it} \quad (5)$$

Description:

For  $i = 1, 2, \dots, N$  and  $t = 1, 2, \dots, T$ .

Where:

$N$  = No. Of cross-sections and  $T$  = No. Of periods.

$\epsilon_{it}$  = The overall residual in this context refers to combining residuals from different cross-sections and time series.

$U_i$  = is the individual residual, which is the random character of unit observation and remains at all times.

Different tests were used to choose the best model. In this model, we used two simple model selection tests. Hausman and likelihood ratio tests.

The Hausman test determines whether to use the Fixed Effect or Random Effect model. Select a Random Effect (RE) if  $p > 0.05$  and a Fixed Effect (FE) if  $p < 0.05$ . The Hausman test checks panel model endogeneity.

The likelihood-ratio test examines if this ratio deviates significantly from one or if its natural logarithm differs significantly from zero. The oldest standard hypothesis tests are Wald, Lagrange multiplier, and likelihood-ratio tests. The latter two tests approximate likelihood-ratio tests asymptotically. The lemma supports the likelihood-ratio test for two models without unknown parameters.

#### 4 Results of Analysis

The descriptive stats of the dependent and the independent variables are given above. Our dependent variable is Tax Revenue, which TRDV represents in the above table, and independent variables are Account ownership, Automated teller machines, Inflation, Personal Remittances, and Unemployment, which are represented by ACC, ATMS, INF, PER, UNEMP, respectively, in the above descriptive stats Table 2.

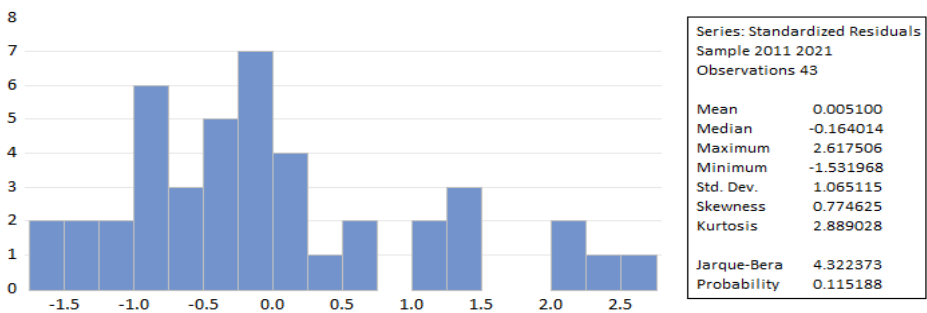
**Table 2:** Descriptive analysis

|        | TR     | ACC    | ATMS  | INF   | PER   | UNEMP |
|--------|--------|--------|-------|-------|-------|-------|
| Mean   | 10.663 | 36.888 | 9.628 | 6.741 | 8.437 | 4.320 |
| Median | 10.177 | 31.740 | 8.516 | 6.908 | 6.319 | 3.910 |



|              |       |        |       |        |        |        |
|--------------|-------|--------|-------|--------|--------|--------|
| Skewness     | 0.752 | 0.629  | 0.487 | -0.221 | 1.451  | 1.238  |
| Std. Dev     | 2.492 | 23.445 | 6.481 | 2.705  | 7.685  | 2.485  |
| Kurtosis     | 3.451 | 2.222  | 2.390 | 2.905  | 3.887  | 4.015  |
| Jarque-Bera  | 4.427 | 3.919  | 2.370 | 0.368  | 16.502 | 12.848 |
| Probability  | 0.109 | 0.140  | 0.305 | 0.831  | 0.000  | 0.001  |
| Z square     | 4.080 | 1.714  | 1.588 | 2.453  | 1.139  | 2.190  |
| Observations | 43    | 43     | 43    | 43     | 43     | 43     |

We estimate variable values using the mean. Tax revenue (10.654), account ownership (40.716), ATMs (10.208), inflation (6.288), unemployment (5.061), and personal remittances (7.354) are the data set's fundamental values. The median is the midpoint value in ascending order. Descriptive statistics include median tax revenues (10.177), account ownership (37.343), ATMs (10.340), inflation (6.217), unemployment (4.350), and remittances (5.950). Jarque-Bera's probability test confirms data normality. Insignificant results imply normal data, while significant results suggest anomalous data. Tax income, account ownership, ATMs, and inflation are normal because their probability values are  $> 0.05$  at 5% intervals, as shown in Table 1. Non-normal data with probability values  $< 0.05$  indicates significant results for unemployment and remittances at 5% intervals. In general, the Jarque-Bera test shows normal variable data. Symmetric data exist at regular intervals around their mean. Data with skewness  $-1$  to  $-0.5$  is negatively skewed;  $0.5$  to  $1$  is positively skewed. Positively and negatively skewed distributions have longer right and flatter left tails. Distribution and weight are described. Our model has positive skews for tax income, account ownership, ATMs, unemployment, and remittances but negative skews for inflation (Table 2). Kurtosis discusses outliers. If it is 3, the data are typical because the outliers are neither more nor less. Tax income, inflation, and unemployment are typical because their kurtosis is near 3, but account ownership, ATMs, and remittances are not. It discusses data dispersion about the mean. Tax revenue (2.610), account ownership (23.752), ATMs (6.426), inflation (2.560), personal remittances (6.457), and unemployment (2.314) depart from their mean levels. The table above shows this. Divide the mean by the standard deviation to get z square. When dividing the mean and standard deviation, a number greater than 1 indicates data dispersion, whereas a value less than 1 indicates data overdispersion. Data is over-dispersed from the central value if standard deviation  $>$  mean and under-dispersed if mean  $>$  standard deviation. All variables in the table above have z square values  $> 1$ , indicating under dispersion.



**Figure 1: Histogram of residual**

Data normalcy is shown via residual histograms. Skewness = 0 and kurtosis = 3 indicate normal distribution. A symmetrical pattern in the random effect model histogram indicates a properly distributed data set. So, all location metrics are in the middle of the distribution: Median=Mode. Residuals are regularly distributed since their probability is  $> 0.05$ . The residuals are positively

skewed due to the low skewness. Kurtosis approaching 3 indicates normal residuals. Overall, the model is normal.

**Table 3:** Likelihood ratio

| Variable Names                             | Coefficient           | Std. Error          | t-statistic                   | p-value.               |
|--------------------------------------------|-----------------------|---------------------|-------------------------------|------------------------|
| ACC                                        | <b>-0.080</b>         | <b>0.014</b>        | <b>-5.805</b>                 | <b>0.00</b>            |
| ATMS                                       | 0.425                 | 0.050               | 8.446                         | 0.000                  |
| INF                                        | 0.006                 | 0.085               | 0.076                         | 0.940                  |
| PR                                         | 0.233                 | 0.024               | 9.851                         | 0.000                  |
| UNEM                                       | 0.287                 | 0.090               | 3.174                         | 0.000                  |
| C                                          | 6.278                 | 0.981               | 6.399                         | 0.000                  |
| Obs =43                                    | <i>F-test</i> = 33.17 | <i>Prob.</i> =0.000 | $R^2 = 0.82$                  | <i>Adj R^2</i> = 0.79  |
| Test summary (Cross section random effect) |                       |                     |                               | <i>P-value</i> = 0.000 |
| <i>Chi-square</i> (6) =0.1750              |                       |                     | <i>Prob</i> < $\chi^2$ =0.000 |                        |

The likely hood ratio test is used to compare the fixed effect model and the ordinary least square model. The p-value reported in Table 3 is significant; therefore, here, the fixed effect is better than the ordinary least square. Hence, these results show that the fixed effect model is more efficient, having smaller standard errors and a consistency property. Therefore, the fixed effect model is more appropriate according to this. This can also be confirmed by a study by King (1989). Now, further Hausman tests are applied to select the proper model.

H0: Random is batter

Ha: Fixed is better.

Table 3 shows that the p-value is negligible; hence, the random effect is better than the fixed effect. Since the random effect model is more efficient and has fewer standard errors and is consistent. In this scenario, the random effect model is better. Thus, the null hypothesis is accepted, and the alternative is rejected. This shows that tax revenue determination varies widely among countries. This heterogeneity is possible due to market conditions and country-specific economic stabilisation policies.

**Table 4:** Results of the random effect model

| Variable Names    | Coefficients          | Std. Error                  | t- value      | p-value.               |
|-------------------|-----------------------|-----------------------------|---------------|------------------------|
| ACC               | -0.078                | 0.015                       | -5.340        | 0.000                  |
| ATMS              | 0.415                 | 0.052                       | 7.916         | 0.000                  |
| INF               | -0.009                | 0.084                       | 0.102         | 0.920                  |
| PER               | 0.234                 | 0.026                       | 9.079         | 0.000                  |
| UNEM              | 0.287                 | 0.090                       | 3.192         | 0.000                  |
| Intercept         | 6.260                 | 1.989                       | 6.334         | 0.000                  |
| Obs =43           | <i>F-test</i> =28.540 | <i>p-value.</i> = 0.000     | $R^2 = 0.790$ | <i>Adj. R^2</i> =0.770 |
| <i>Chi-sq</i> (5) | 5.325                 | <i>Prob</i> < <i>Chi-sq</i> | 0.380         | <i>P-value</i> = 0.380 |

TR = 6.26 - 0.08(ACC) + 0.42(ATMS) - 0.01(INF) + 0.23(PER) + 0.29(UNEM)

Table 4 shows that the crucial value of t is significant for individual account ownership (ACC), personal remittance (PER), unemployment (UNEM), and automated teller machine (ATMS), while inflation (INF) is minor. The F-test is 28.54. Before using, check this F-value against the F Table. The whole model is significant (Prob. = 0.000). According to Adj, account ownership, ATMs, inflation, personal remittance, and unemployment explain 77% of tax revenue fluctuation.

R2. Standard Error shows that each slope deviates many times from the anticipated line (Table 4). In this model, a control variable eliminated missing variable bias. The graph illustrates that when account ownership increases, revenue will increase if the control variable is not utilised in this model. However, regression shows that it is not positive.

Table 4 shows intercept 6.26, the tax income generated if all independent variables are 0. Account ownership, ATMs, inflation, personal remittance, and unemployment cannot explain this. One unit increase in bank account ownership decreases tax income by 0.078% (ACC coefficient - 0.078). The account ownership (ACC) t-value is -5.340, which does not support hypothesis 1. It means ACC affects TR significantly. The p-value is below 0.05, supporting it. ACC is negative when a person has an account, is financially knowledgeable, and knows about banking taxes. They avoid taxes with bank transactions. An increase in the bank account does not mean account holders have a balance and use it for all financial matters. Financial understanding does not boost tax income. Pakistan offers tax concessions to encourage tax savings. If the government taxes filers and non-filers equally, tax revenue will rise.

The coefficient of ATMS is 0.415 and significant at 0.001 level. It implies that an increase in ATMS by one unit causes an increase in tax revenues by 0.415. The t-value of the automated teller machine (ATMS) is 7.916, which implies that the coefficient of ATMS is statistically significant and supports hypothesis 2. The inflation coefficient is negative but insignificant as its t-value is 0.102, and the p-value is more significant than 0.05. This means the relationship between inflation and tax revenues is not statistically significant. It may change subject to any change in the data set, such as the number of observations, sample size, number of regressors, estimation technique, etc. The coefficient of PR is 0.234 and is statistically significant at 0.01 level. Tax revenue will increase by 0.234 times in response to a unit increase in personal remittances. Thus, the relationship between personal remittances and tax revenues is positive. However, it relies on several variables, including the origin of the remittances, the tax laws of the receiving nation, and how recipients spend their remittances. Remittances can help the government raise more money through taxes if the recipient nation levies taxes on the remittances. Furthermore, remittances may help boost economic activity in the recipient nation, increasing tax receipts for the government. Recipients often invest or spend the money they get when they receive remittances, which can increase economic growth and tax revenue for the government. However, the effect of remittances on tax income depends on how the recipient of remittances or the government uses these funds.

The coefficient of UNEM is 0.287, which is significant at a 0.01 level. The t-value of unemployment (UNEM) is 3.192, and its p-value is less than 0.05, so the relationship between tax revenues and unemployment is statistically significant. It depicts that tax revenues will increase by 0.287 times in response to a unit increase in unemployment. The predictor variables strongly correlate with the response variable, as indicated by the panel data regression's Adj. R<sup>2</sup> value of 0.77. It tells that a 77% variance in tax revenue (TR) has been explained by account ownership (ACC), automated teller machine (ATMS), inflation (INF), personal remittance (PR), and unemployment (UNEM).

## 5 Discussion, Conclusion, and Policy Recommendations

This study aims to estimate the effect of financial inclusion and digital financial services on tax revenue mobilization in South Asian countries. For this purpose, panel estimators (fixed effect and random effect) were applied to the data set of six South Asian developing countries for the period 2010 to 2021. The data on tax revenues, financial inclusion, digital financial services, and control variables (inflation, unemployment, personal remittances) were retrieved from the World Bank's WDI database. The random effect estimator results show that changes in financial inclusion, digital financial services, personal remittances, and unemployment determine 77% of changes in the tax revenues in South Asian economies. The study's findings establish that an increase

negatively influences tax revenues in South Asian economies in financial inclusions. On the other hand, an increase in digital financial services causes an increase in tax revenues. These findings are consistent with the findings of earlier studies. Financial inclusion causes an increase in the people's financial literacy, and they would start to save their taxes by breaking their financial transactions. Further, it might be due to a need for more tax incentives for making transactions through bank accounts. An increase in the provision of digital financial services facilitates people to make transactions through banking channels, so there is less possibility of evading taxes.

For instance, the World Bank (2021) emphasises that financial inclusion and digital financial services influence tax revenue mobilization in South Asia. Demircuc-Kunt et al. (2015) demonstrated that significant variation in income tax is due to financial inclusions and digital financial services. Further, the findings of this study are supported by Claessens and Perotti (2007). They have found evidence that financial inclusion has a detrimental effect on tax revenues. Siriringoringo & Anugrahini (2023) highlight the necessity of comprehending the intricate correlation between financial inclusion and tax compliance. The research suggests that financial inclusion could enhance tax avoidance. Studies indicate that knowledge and understanding of financial matters enhance the likelihood of being included in the financial system. Allen et al. (2016) emphasize the significance of financial education programs that must carefully balance empowering individuals and encouraging responsible financial conduct. This study offers significant insights into the correlation between financial inclusion, digital financial services, and the mobilization of tax income in South Asian nations.

The financial industry recognizes the benefits of financial technology. This study found a positive correlation between digital financial services and tax revenues. Recently, Hasan et al. (2023) reported similar results. Digital financial services can reduce tax avoidance by encouraging lawful banking, according to Smith (2017). This shows that technology can improve financial openness and mitigate financial crime

Based on the findings of the study, it is concluded that an increase in financial inclusions and higher usage of digital financial services significantly impact tax revenue generation in South Asian countries. Further, the study's findings suggest that the policymakers of South Asian countries should develop strategies for promoting digital financial services in their respective countries. They should facilitate financial institutions to increase the number of automated teller machines in malls, markets, service centres, workplaces, etc. Further, the use of e-wallets, e-banking, and e-coins should be encouraged. Free internet facilities should be provided in shopping malls, market centres, and other service centres. This would help mobilize tax revenue and stimulate the economies to run better. The World Bank (2019) emphasizes the necessity of investing in technology infrastructure and encouraging digital transactions. By facilitating electronic transactions, digital financial services promote a society where physical currency is not required, streamlining daily activities and enhancing the visibility and accountability of the financial system. This, in turn, acts as a deterrent to tax evasion. The intricate interplay underscores the necessity for tailored policies that leverage digital financial services while mitigating the perils of financial inclusion. For future studies, it is suggested that the factors affecting the expansion of digital financial services in South Asian countries be analyzed. The findings of this study further emphasize the importance of addressing financial literacy and inclusion. The surprising relationship between financial inclusion and tax compliance needs to be reassessed. The significance of a comprehensive analysis of the structure and motivations of financial inclusion programs is suggested.

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