



# Determinants of financial inclusion in sub-Saharan Africa and OECD countries

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## ABSTRACT

Using a dynamic panel data analysis, we explore the factors that influence financial inclusion in sub-Saharan Africa (SSA) and other regions, using member countries of the Organization for Economic Cooperation and Development (OECD) as a benchmark. We employ a system generalized methods of moments estimator and assess 31 SSA and 38 OECD countries from 2000 to 2021. We show that the literacy rate, trade openness, political stability, bank efficiency, income, and remittances are key factors with various impacts across regions. We further show that various dimensions of a financial system (access, usage, and quality) are impacted by different indicators and to varying extent. We account for events during the period, such as the global financial crisis and COVID-19 outbreak. We highlight the importance of quality literacy policies and a more efficient financial system in promoting financial inclusion. We recommend improving trade regulatory frameworks that promote trade openness through stronger institutions.

## 1. Introduction

Financial inclusion represents the provision of financial services and products to unbanked and underbanked populations at an affordable cost (Chibba, 2009) to ensure equal access to finance for individuals and businesses (Oanh, 2024). It strengthens the financial system, facilitating increases in the share of income, access to savings and credit, and the flow of funds from individuals or entities with a surplus to those with deficit spending, ultimately promoting economic growth (Sethi & Acharya, 2018) and breaking the cycle of poverty (Zhang & Posso, 2019). As such, researchers in developed countries such as members of the Organization for Economic Cooperation and Development (OECD) and developing countries, such as those in sub-Saharan Africa (SSA), have largely achieved a consensus that financial inclusion is one of the main pillars of global development (Morgan & Pontines, 2018; Xu &

Sun, 2022). However, significant disparities persist in the level of financial inclusion across regions, in which Africa faces much greater challenges than developed countries in the OECD. Therefore, in this paper, we assess the determinants of financial inclusion, explore the differences in their influence across regions, and identify the international determinants of financial inclusion practices that are common in regional groups.

Our contribution to the literature goes beyond the disparity in financial inclusion levels previously established. In 2021, the Global Financial Inclusion Index report compared the level of financial inclusion globally and found that, on average, SSA has among the lowest levels of financial inclusion, with only 55% of the population having access to basic financial services (Demirgüç-Kunt et al., 2022).<sup>1</sup> Seven economies, including Nigeria, a sub-Saharan African country, and Egypt, are among the top five with the least levels of financial inclusion,

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<sup>1</sup> In contrast, the East Asian and Pacific region has the highest level of financial inclusion, 80.9%, followed by Europe and Central Asia (77.8%), Latin America and the Caribbean (72.9%), and South Asia (67.9%), but the level is low in the Middle East and North Africa (48.1%) (Demirgüç-Kunt et al., 2022).

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together accounting for 54% of the world's unbanked population. By comparison, in high-income economies, this disparity is minimal, as almost all the adults there have access to financial accounts (Demirgüç-Kunt et al., 2022). Hence, the essential benchmark variables or indicators that can be targeted to achieve strategic enhancements in financial inclusion need to be identified. They will serve as navigational aids for SSA in order to guide efforts to create a more inclusive financial environment that will ultimately contribute to broader economic development and social progress. We consider the different stages of financial development, highlighted by various events, including the impact of COVID-19 on the financial market. Hence, we contribute to the literature by exploring new and key macro-level factors that have not been studied before and their impact on financial inclusion in SSA through a comparison with more advanced regions.

Despite the significant investment made to increase accessibility to financial services (Demirgüç-Kunt et al., 2022; Gebrehiwot & Makina, 2019), disparities in financial inclusion levels persist, which might result from variations in the predictive power of factors such as jurisdictions, the structure of the financial sector, and the regulatory environment (Dabla-Norris et al., 2015). These disparities also involve infrastructure, financial literacy, digital connectivity issues, and the extent of the informal economy, all of which hinder progress in the region (Beck et al., 2015; Mukherjee & Sood, 2020). Given the severe resource constraints that governments in many African countries face, stakeholders and others might expect the business sector to play an active role in expanding financial accessibility (Ibne Afzal et al., 2023). For example, in the financial industry, corporate social responsibility (CSR) is a concept that can be intertwined with this discourse on disparity in financial inclusion.<sup>2</sup> All these factors might result from the lack of financial innovation based on Schumpeter's evolution theory (Schumpeter & Swedberg, 2021). The evolutionary theory is based on the fact that societal systems evolve, and, in the case of financial inclusion, this evolution is influenced by various factors. Other papers also emphasize the role of information asymmetry in conditions of uncertainty, which leads to credit rationing and exclusion from the financial sector (Dimova & Adebawale, 2018).

Recent papers have examined the factors that influence financial inclusion (Alber, 2019; Eldomiaty et al., 2020; Gebrehiwot & Makina, 2019; Kabir, 2022, pp. 1556–1581; Neaime & Gaysset, 2018; Ozili, 2021; Zins & Weill, 2016). However, they do not adequately address financial inclusion using regional comparisons. Most of these studies focus on Africa at the micro level, overlooking how financial inclusion is achieved in advanced countries, such as members of the OECD. A macro-level perspective considers more significant shifts in economic and social contexts with regard to the lasting benefits for individuals at the micro level. Studies from the perspective of global financial inclusion often exhibit bias by failing to consider its multidimensionality in terms of availability, usage, and quality. Some studies construct an index to account for the multidimensionality of financial inclusion (Park & Mercado, 2015; Sarma, 2008). However, they often set arbitrary weights, at the discretion of the author (Nguyen, 2021). Thus in calculating a financial inclusion index to address this problem, Cámara and Tuesta (2014) advocate using statistically identified and applied weights. Therefore, a notable gap is found in the literature with respect to a cross-regional comparison using a statistically weighted index that can provide a reference point for improving financial inclusion, helping to form a set of shared practices and policies. We explore the factors that contribute to, drive, or reinforce financial inclusion and compare them to those in other regions.

The focus of our assessment is motivated by the significant disparity in access to financial services and products between regions represented by the SSA and OECD countries. Huang et al. (2021) highlight the unbalanced global distribution of financial resources, noting that, whereas the countries in the eurozone enjoy high levels of financial access, those in sub-Saharan Africa (SSA) continue to lag behind (despite increasing from 29% to 33% in 2014–2017). Although other regions could be compared, we compare SSA and the OECD, as a benchmark, deliberately. The OECD members are developed countries around the world and are more financially inclusive than SSA countries. Hence, this choice enables us to consider a wide selection of countries in different regions (see Appendix Table A1). In this way, we avoid using specific regions as benchmarks but still have representative countries from regions in the benchmark sample.<sup>3</sup> The OECD countries form a uniformly strong global benchmark and a spectrum of financial inclusion levels. Although some OECD members are highly financially inclusive, others are still developing in this regard, though they are more financially inclusive than SSA. This diversity provides a more comprehensive baseline for comparison with SSA than a single region would. Additionally, the diversity and economic stability of OECD countries provide a robust baseline for our analysis, creating a comprehensive comparison to SSA. High-income OECD countries, such as the Netherlands, the United States, the United Kingdom, Switzerland, Finland, and Norway, have full access to financial institutions (Huang et al., 2021). Therefore, the OECD is an ideal region for comparison with SSA regarding financial inclusion.

We use a system-generalized method of moments (SGMM) dynamic panel estimator to estimate our model, accounting for potential endogeneity. Financial inclusion is measured using principal component analysis (PCA) to construct a statistically weighted Financial Inclusion Index (FII) that accounts for the multidimensionality of the financial system, including access, usage, and quality. In addition, we assess the impact of different indicators on these individual dimensions of financial inclusion. The indicators might affect each financial inclusion dimension differently and to a different extent. As a robustness check, we conduct a similar analysis for six standard individual variables of financial inclusion. Our key findings suggest that the literacy rate, trade openness, banks' efficiency, income, and remittances are key macro-level factors that have different impacts on financial inclusion in the two regions. Further, unlike in OECD countries, in SSA the global financial crisis (GFC) and COVID-19 had no negative effect on the financial inclusion levels. These results have important implications for SSA policymaking, as addressing these factors could promote greater regional financial inclusion.

Our research has significant policy relevance for the promotion of greater financial inclusion in SSA from a global perspective. By examining the determinants of financial inclusion across regions, we reveal the key factors that influence the access, usage, and quality of financial inclusion. This regional assessment exposes the impact of globalization on financial inclusion. We examine the influence of cross-border financial flows, such as remittances and trade openness, on a region's financial inclusion by affecting the availability of financial services and the integration of local economies into the global financial system. We make a significant contribution by assessing significant global economic events, such as the financial crisis and COVID-19, and their impact on financial inclusion in the two regions. We also offer some insights into the contribution of cryptocurrency to financial inclusion in the digital age. We focus on how to improve financial inclusion levels in SSA and other developed regions by identifying the challenges to and opportunities for promoting economic sustainability.

The paper is organized as follows: Section 2 reviews the literature on

<sup>2</sup> CSR is direct investment or an indirect initiative that contributes to sustainable development by delivering economic, social, and environmental benefits that can reduce disparities in financial inclusion (Ibne Afzal et al., 2023). These activities encompass the notion that we do well by doing good (Falck & Heblich, 2007).

<sup>3</sup> The OECD comprises 38 countries in Asia (3), Europe (27), North America (4), Oceania (2), and South America (2). According to the available data (see note 1), these countries are in regions that are more financially inclusive than SSA.

the determinants of financial inclusion, Section 3 describes the data and measurement methods, Section 4 provides the methodology and main estimations employed, Section 5 discusses the main empirical results, Section 6 presents a robustness test, and, finally, Section 7 offers policy directions and suggestions for future research.

## 2. Literature review

### 2.1. Theoretical literature

Various studies on the determinants and impact of financial inclusion across different countries and regions are based on the public good theory of financial inclusion by Ozili (2020). This theory posits that certain goods and services should be accessible to all members of society because of their non-excludability and nonrivalrous consumption. Hence, one person's use of these goods does not reduce their availability to others, and it is difficult to exclude anyone from using them (Damra et al., 2023).

In the context of financial inclusion, public goods theory suggests that everyone should have access to financial services (Damra et al., 2023). According to Ozili (2020), the key financial inclusion services are automated teller machines (ATMs), bank accounts, credit cards, debit cards, and bank deposits. Financial inclusion, defined as the accessibility to and use of affordable financial services by individuals and businesses, is essential for social inclusion. It ensures that underserved and vulnerable groups have access to financial products and services, such as savings accounts, credit, insurance, and payment systems. From an economic standpoint, these financial services might not be classified as a public good because individuals can be excluded from access to them. However, like primary education and basic health care, financial inclusion is regarded as a public good because excluding people from essential services, such as savings accounts, is neither desirable nor justifiable (Ngakosso, 2024). This theoretical framework helps show the determinants of financial inclusion, including its externalities. Although public good theory seems appropriate to financial inclusion, it does not address the root causes of financial exclusion and may lead to excessive costs for the government (Damra et al., 2023).

Furthermore, new institutional economics theory, proposed by North (1986) and later developed by Bardhan (1989), explains that institutions, such as social and legal norms, underlie all economic activities. According to North (1991, p. 97), "Institutions are humanly devised constraints that shape human interaction be it in a political, social or economic setting." In the context of financial inclusion, Ozili (2023) explains that people's interactions with formal and informal institutions influence their decisions about whether to engage with the formal financial sector. Institutions that build trust in formal financial institutions can encourage unbanked individuals to use these services. However, institutions that foster mistrust, because of high transaction costs, bank charges, fear of bank failure, and exposure to fraud, can deter people from using these services. Hence, in explaining the determinants of financial inclusion, institutional theory reinforces the usefulness of certain institutions in influencing financial inclusion levels. Beyond governance structures, the institutions that enable or constrain the behavior of economic agents are considered economic institutions (Frimpong et al., 2023).

### 2.2. Concept of financial inclusion

Various definitions have been given in the literature to expand the concept of financial inclusion to portray its broad nature (Demirgüç-Kunt, 2018; Pesqué-Cela et al., 2021). Although the concept of financial inclusion is not consistent, it is generally understood that financial inclusion encompasses the idea that all individuals and businesses, irrespective of their income or location, have access to affordable financial products and services, such as bank accounts, credit, insurance, and investment opportunities, that meet their requirements

(Demirgüç-Kunt, 2018). The development of this concept has undergone several revisions over time. Early definitions stressed that different demographic groups should be able to access financial services. Recent discussions on financial inclusion now cover more than just access to formal financial institutions; they include the usage, cost, and quality of financial services. In more comprehensive definitions, "access" refers to the availability of financial services, and "use" denotes their actual usage. The "cost" dimension of financial inclusion includes financial and nonfinancial expenses incurred in accessing financial services, such as bank fees and physical accessibility. The "quality" aspect considers the suitability and relevance of financial services and products to meet the needs of individuals and businesses (Pesqué-Cela et al., 2021).

### 2.3. Empirical literature: determinants of financial inclusion

Empirical studies have identified various determinants of financial inclusion, which can be divided into macroeconomic, policy, cultural, socioeconomic, and industry-specific factors.

#### 2.3.1. Macroeconomic factors

Empirically, financial inclusion can be influenced by specific macroeconomic determinants. For instance, Evans (2015) posits that economic growth and higher GDP per capita contribute to a more inclusive financial system by increasing the availability of financial resources and enhancing the ability of individuals to participate in the formal financial sector. Countries with higher GDP per capita typically have more comprehensive financial systems, which support increasing levels of financial inclusion (Le et al., 2019). Similarly, financial globalization is identified as a significant driver of financial inclusion, particularly in SSA, by combining local financial systems with global markets and facilitating broader access to financial services (Bashiru et al., 2023).

Inflation is another macroeconomic factor that influences financial inclusion, albeit with varying effects. Whereas some studies indicate that high inflation rates can undermine financial inclusion by eroding the value of financial assets and discouraging savings (Yin et al., 2019), others suggest that its impact is less significant in certain regions, such as Africa (Evans, 2015). Damra et al. (2023) highlight that public debt negatively affects financial inclusion by increasing the cost of credit and limiting the availability of financial services, thereby restricting access for individuals and businesses. Allen et al. (2016) emphasize that, in countries with higher rates of employment, individuals are more likely to have a bank account, thereby increasing their financial inclusion. Moreover, unemployed adults are likelier to say that they lack enough money to use an account. Higher employment rates are often correlated with higher income, which enhances the ability to save, invest, and use credit facilities (Chu, 2019; Demirgüç-Kunt et al., 2022).

#### 2.3.2. Institutional and policy factors

According to Pearce (2011), countries with well-defined financial regulations tend to have higher levels of financial inclusion. Pearce explains that a financial regulatory framework that facilitates access to finance through banks, such as commercial banks and credit unions, mobile phone technology, and finance companies can significantly enhance financial inclusion. People in the countries with the highest regulatory quality are 12.4 percent more likely to have an account at a financial institution than those in countries in the lowest quartile (Chen & Divanbeigi, 2019). Eldomiaty et al. (2020) contend that global financial inclusion requires consideration of significant world governance indicators, including control of corruption, government effectiveness, political stability, and voice and accountability. Strong institutions build trust in the financial system, making people more likely to employ formal financial services (Allen et al., 2016). Law (2009) shows that trade openness and capital flows significantly determine financial development in developing countries, with institutional quality playing a crucial role.

### 2.3.3. Cultural and socioeconomic factors

Cultural and geographical characteristics affect people's participation in a financial system, often linked more to their location than their identity (Corrado & Corrado, 2015). In addition to gender and income, factors such as age, education, and living in a rural area also play a crucial role in determining the likelihood of owning a financial account (Demirgüç-Kunt et al., 2022). In East Africa, living in a rural area and income are the two most essential criteria for financial inclusion, and a larger rural population is correlated with higher levels of financial inclusion (Wokabi & Fatoki, 2019). In southern Africa, age, gender, and educational attainment are critical factors in explaining access and exclusion patterns (Johnson & Nino-Zarazua, 2011). In Central and West Africa, personal characteristics such as gender, education level, age, income, place of residence, employment status, marital status, household size, and trust in financial institutions heavily influence access to formal finance (Soumaré et al., 2016). Chikalipah (2017) and Chinoda and Kwenda (2019) highlight the effect of illiteracy on financial inclusion in SSA, emphasizing the need for bank competition and financial stability through monitoring and regulatory evaluations.

### 2.3.4. Industry-specific factors

Prior papers have suggested that financial inclusion in the European Union's financial system is premised on financial stability, and increasing account ownership reduces bank default risk, especially for disadvantaged individuals (Danisman & Tarazi, 2020). The rise of banks in Africa has played an essential role in improving access to financial services by fostering financial innovation, competition, and financial system development (Mukherjee & Sood, 2020). Likewise, sharia-compliant finance in Islamic banking demonstrates improvement in financial inclusion levels. However, in many African countries, deposit rates are too low to support expansion in financial usage (Evans, 2015). Financial system development alone is not sufficient for financial inclusion. In Uganda, mobile money accounts serve as a significant gauge of financial access, though their usage remains limited (Hamdan et al., 2022). Avom et al. (2023) state that mobile financial services can significantly increase financial inclusion in Africa by providing low-cost services. Nonetheless, ongoing limitations in physical infrastructure, such as inadequate internet connectivity, persistently hinder the potential impact of mobile money (Ky et al., 2018). Other papers find a positive relationship between CSR and financial inclusion in banking (Bhatter & Chhatoi, 2023; Ramzan et al., 2021; Vo et al., 2022).

Other empirical studies have examined financial inclusion in areas such as financial stability (Wang & Luo, 2022), the use of technology (Kabir, 2022, pp. 1556–1581), and innovation (Chung et al., 2023). However, most of these studies exclude many countries and indicators and do not consider the significant differences in financial inclusion among regions.

## 3. Data

We use panel data to investigate the predictive factors of financial inclusion in 31 SSA countries and 38 member countries of the OECD for the 22-year period from 2000 to 2021. The countries included in our study are listed in Appendix Table A1. This period is intended to capture events such as the introduction of cryptocurrency in 2009 and part of the COVID-19 pandemic, which may have impacted the financial market and the services provided during the study period. We also account for the impact of the GFC in 2007–2010. We employ secondary data from the Global Financial Development and World Development Indicators databases. Appendix Tables A2 and A3 list all the data used in our study.

We use the World Bank's Global Financial Development database on financial inclusion, as it covers more countries and indicators, providing a more comprehensive and nuanced understanding of financial inclusion globally. The database includes information on access, usage, depth, and quality/efficiency of financial services and products, providing a broader and more relevant picture of financial inclusion globally.

We do not perform estimations at an individual level but, rather, conduct a macro-level analysis. Through this approach, we reveal systemic insights and identify long-term and sustainable solutions, considering how changes in the broader economic and social context can enhance financial inclusion. Focusing on these systemic factors will ultimately have lasting benefits for individuals.

### 3.1. Financial inclusion index

The concept of financial inclusion goes beyond single indicators, such as the number of deposit accounts and ATMs or bank branches (Cámara & Tuesta, 2014). Hence, following Sharma and Changkakati (2022), we construct a Financial Inclusion Index (FII) to account for three dimensions of financial inclusion: access to, usage of, and quality of financial products and services. The specific dimensions are defined with the use of relevant variables (Table 1).

#### 3.1.1. Access (geographic availability of financial services)

Access explains the public availability of financial products and services, which enables usage. Following Ugwuanyi et al. (2022) and Cámara and Tuesta (2014), we measure access ( $A_i$ ) by the number of ATMs per 100,000 adults and bank branches per 100,000 adults. These variables account for the physical location of services offered by financial institutions (Cámara & Tuesta, 2014). Although technology in the financial sector, such as mobile money and internet banking, offers a different measure of access, the role of distance should not be underestimated in people's ability to access financial services. Mobile money and internet banking typically rely on having a registered mobile device, a registered phone number, and a reliable internet connection (Hamdan et al., 2022). These measures tend to have a substantial impact in countries and areas that are already wealthier, urban, and well-connected to infrastructure (Fabregas & Yokossi, 2022). Including ATMs and bank branches in the FII measures the level of financial inclusion and captures the development of banking infrastructure in a country. According to Demirgüç-Kunt et al. (2022), people in poverty and women are at a higher disadvantage in terms of either not having access to mobile phones or being located far from a bank branch, and thus might need support to access and use a bank account.  $A_i$  is calculated using PCA as:

$$A_{it} = \beta_1 ATMs_{it} + \beta_2 Branches_{it} \quad (1)$$

where  $A_{it}$  is access at time  $t$ , and  $\beta_1$  and  $\beta_2$  are the respective weights for ATMs and bank branches.

#### 3.1.2. Usage

According to Bui and Luong (2023), financial inclusion requires access to financial services and their active use through deposits, credit, payments, transfers, and other transactions. Many people in certain countries have bank accounts and financial products but use very few services. Consequently, having accounts or a large number of ATMs in a financial system becomes meaningless if they are not used (Nguyen, 2021; Sarma, 2016). To measure usage, Cámara and Tuesta (2014) consider the usefulness of financial services in three areas: having savings or deposits, contracting a loan, and possessing at least one financial product. In line with this perspective, we use bank deposits and bank credit as indicators to measure usage ( $U_i$ ). Lenka and Barik (2018) call these indicators "banking usage penetration." We use PCA to construct  $U_i$ :

$$U_{it} = \beta_1 Deposits_{it} + \beta_2 Credits_{it} \quad (2)$$

where  $U_{it}$  is usage at time  $t$ , and  $\beta_1$  and  $\beta_2$  are the respective weights for bank deposits and bank credits to deposits.

#### 3.1.3. Quality

Quality is used to describe financial products or services that aim to

**Table 1**  
Determinants of financial inclusion in SSA.

|                                           | SSA                            | GFC                            | COVID-19                       |
|-------------------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Lagged financial inclusion index (L. FII) | 0.773 <sup>a</sup><br>(0.061)  | 0.823 <sup>a</sup><br>(0.057)  | 0.734 <sup>a</sup><br>(0.090)  |
| Cultural and socioeconomic factors        |                                |                                |                                |
| Literacy rate                             | 1.864 <sup>b</sup><br>(0.634)  | 1.557 <sup>c</sup><br>(0.709)  | 2.321 <sup>c</sup><br>(0.926)  |
| Remittances                               | −0.071 <sup>a</sup><br>(0.020) | −0.080 <sup>b</sup><br>(0.025) | −0.069 <sup>b</sup><br>(0.021) |
| Policy factors                            |                                |                                |                                |
| Trade openness                            | 0.007 <sup>c</sup><br>(0.003)  | 0.003<br>(0.004)               | 0.009 <sup>c</sup><br>(0.004)  |
| Government expenditure (GE)               | −0.006 <sup>b</sup><br>(0.002) | −0.004<br>(0.003)              | −0.004 <sup>c</sup><br>(0.002) |
| Institutional factors                     |                                |                                |                                |
| Political governance                      | 0.158 <sup>c</sup><br>(0.072)  | 0.270 <sup>c</sup><br>(0.110)  | 0.132<br>(0.086)               |
| Tax governance                            | −0.018<br>(0.009)              | −0.022 <sup>c</sup><br>(0.009) | −0.023 <sup>c</sup><br>(0.010) |
| Effective trade protocol                  | 0.009 <sup>c</sup><br>(0.004)  | 0.008<br>(0.004)               | 0.006<br>(0.004)               |
| Macroeconomic factors                     |                                |                                |                                |
| Income                                    | −0.025 <sup>b</sup><br>(0.008) | −0.027 <sup>a</sup><br>(0.008) | −0.014<br>(0.013)              |
| Inflation                                 | −0.008<br>(0.016)              | −0.016<br>(0.014)              | −0.002<br>(0.018)              |
| Employment                                | −0.002<br>(0.008)              | 0.004<br>(0.007)               | −0.005<br>(0.011)              |
| Industry-specific factors                 |                                |                                |                                |
| Bank efficiency                           | 0.045 <sup>a</sup><br>(0.011)  | 0.041 <sup>b</sup><br>(0.015)  | 0.041 <sup>b</sup><br>(0.013)  |
| Gross capital formation (GCF)             | −0.015 <sup>c</sup><br>(0.006) | −0.008<br>(0.007)              | −0.014 <sup>c</sup><br>(0.007) |
| Time-fixed effects                        |                                |                                |                                |
| Global financial crisis                   |                                | −0.180 <sup>b</sup><br>(0.067) |                                |
| COVID-19                                  |                                |                                | 0.417<br>(0.358)               |
| Constant                                  | −1.209<br>(0.818)              | −0.627<br>(0.796)              | −1.014<br>(0.762)              |
| Diagnostics                               |                                |                                |                                |
| Fisher                                    | 241,400.73                     | 375,124.59                     | 278,304.48                     |
| Prob. (Wald)                              | 0.000                          | 0.000                          | 0.000                          |
| AR1 (p-value)                             | 0.030                          | 0.024                          | 0.034                          |
| AR2 (p-value)                             | 0.350                          | 0.120                          | 0.798                          |
| Hansen-J OIR (p-value)                    | 0.939                          | 0.940                          | 0.951                          |
| Sargan OIR (p-value)                      | 0.133                          | 0.197                          | 0.112                          |
| DHT for instrument                        |                                |                                |                                |
| Instruments at levels                     |                                |                                |                                |
| H Excluding group                         | 0.633                          | 0.364                          | 0.339                          |
| Dif (null, H = exogenous)                 | 0.919                          | 0.945                          | 0.958                          |
| IV (years, eq (diff))                     |                                |                                |                                |
| H Excluding group                         | 0.943                          | 0.935                          | 0.965                          |
| Dif (null, H = exogenous)                 | 0.360                          | 0.458                          | 0.279                          |
| Observations                              | 194                            | 194                            | 194                            |

Notes: Statistical significance.

<sup>a</sup> 0.1%.

<sup>b</sup> 1%, and.

<sup>c</sup> 5%. Standard errors are in parentheses.

improve the financial service experience, fulfill financial needs, and ease financial burdens. This dimension also captures elements of financial innovation, as they are mostly personalized based on specific risks, individual traits, and available options. Therefore, we adopt two measures that reflect the quality dimension ( $Q_t$ ). Life insurance is defined as the ratio of the premium volume of life insurance to a country's GDP, and non-life insurance is defined as the ratio of the premium volume of life insurance to a country's GDP. Developed countries prioritize insurance coverage because of its importance in protecting individuals and their assets. By incorporating it into FII, we quantify insurance penetration in both regions as part of the level of financial inclusion. As with the other dimensions, we employ PCA to construct  $Q_{it}$  as follows:

$$Q_{it} = \beta_1 \text{Life} - \text{Insurance}_{it} + \beta_2 \text{Non} - \text{Life Insurance}_{it}, \quad (3)$$

where  $Q_{it}$  is usage at time  $t$ ,  $\beta_1$  and  $\beta_2$  are the respective weights for life insurance and non-life insurance.

Following Nguyen (2021), we use the PCA approach introduced by Cámara and Tuesta (2014) to create a comprehensive index of financial inclusion. According to Cámara and Tuesta (2014), single measures, such as bank branches and the number of ATMs, depict only a portion of coverage, not a multidimensional variable. Many studies have used PCA or Sarma (2008) to measure FII by assessing the multidimensionality of financial inclusion. Sarma (2008) creates an index similar to the Human Development Index (HDI) but uses arbitrary dimensional weights (1, 0.5, and 0.5 for access, availability, and usage, respectively). The use of PCA avoids the problem of weight assignment (e.g., Hodula, 2023) through the use of statistical weights and less arbitrary weights and offers a harmonized and comprehensive measure based on a large set of indicators. Iwasaki et al. (2022) further elaborates that it helps to show the aggregate impact of factors without omitting any particular indicator and avoids correlation among different individual indicators. To ensure coherent and consistent results, we conduct a re-estimation to measure financial inclusion using the number of ATMs per 100,000 adults.

In this way, we constructed an FII for every country  $i$  and period  $t$  as follows:

$$FII_{it} = W_1 A_{it} + W_2 U_{it} + W_3 Q_{it} + e_{it} \quad (4)$$

where  $A_{it}$ ,  $U_{it}$ , and  $Q_{it}$  are the access, usage, and quality dimensions of financial services and products;  $W_1$ ,  $W_2$ , and  $W_3$  are the relative weights of each dimension, and  $e_{it}$  is an error term.

The FII variables are all standardized to have a mean of 0 and a standard deviation of 1, ensuring comparability. Although the access, usage, and quality dimensions cannot be presented directly as PCA components, the eigenvalues of the first three components explain the majority of the variance in the data; the details are in Appendix Tables A4 and A5. In OECD countries, these components account for 82.4 percent of the variations in the construction of the FII, whereas in SSA countries, they account for 94.0 percent. The traditional procedure, in which a component is interpreted based solely on the variables with high loadings in the component, is not always successful at reducing the dimensionality of the index or facilitating interpretation of the component of the index (Al-Kandari & Jolliffe, 2005).

### 3.2. Determinants of financial inclusion

In the next step, we compile a set of theoretically and empirically motivated variables related to the determinants of financial inclusion (see Appendix Table A3). Our chosen factors are divided into subsets for macroeconomic factors, policies, cultural and socioeconomic factors, industry-specific factors, and institutional factors (political and economic institutions).

#### 3.2.1. Macroeconomic factors

Income is captured through GDP growth per capita to show its impact on accessing financial services, following Tsouli (2022). Our measurement shows that higher-income countries tend to engage in more financial undertakings and have better access to financial services.

Further, we use the employment rate as a macroeconomic determinant and measure it using the share of the population employed in a country. The employment rate could influence financial inclusion by increasing income, access to credit, and bank accounts (Chu, 2019).

We employ inflation as a determinant because studies have shown its impact on the performance of the financial sector (Monsalve-Cobis et al., 2017). We prefer to use inflation rather than the interest rate because inflation is often seen as a broader economic indicator (Girdzijauskas et al., 2022) and impacts people's behavior more than interest rates

because of changes in prices over time. When inflation is highly volatile, financial inclusion might be reduced because of people's reaction to a reduction in the value of their cash holdings (Omar & Inaba, 2020).

### 3.2.2. Policy factors

Like Ugwuanyi et al. (2022) and Mulungula and Nimubona (2022), we employ trade as a measure of trade openness. It measures the sum of imports and exports expressed as a ratio of GDP. We theorize that financial innovation often accompanies trade openness, as it necessitates efficient cross-border financial transactions, leading to innovative financial products and services. Trade openness reflects the level of international trade per country and the flow of funds through a financial system due to trade.

We include government expenditure, as it reflects the funding and policies enacted to enhance trust and participation in the financial system. We measure it as the annual percentage growth in final government consumption expenditure, which includes all current government expenditures on purchases of goods and services, including employee salaries. Government commitments through substantial spending in public works and programs can significantly enhance financial inclusion (Ghosh, 2019).

### 3.2.3. Cultural and socioeconomic factors

We include personal remittances received as a measure of remittance inflows as they account for all transfers and compensation between residents and nonresident individuals and households (Saydaliyev et al., 2020). Remittances can promote financial inclusion through integration in globalization and by increasing demand for the establishment of bank accounts and other forms of savings, as well as inquiries for banking services. Therefore, remittances might lead to a rise in the use of bank products (Anzoategui et al., 2014; Saydaliyev et al., 2020).

Using tertiary school enrollment as a proxy, we measure the literacy rate, following Omar and Inaba (2020) and Tsouli (2022).<sup>4</sup> Tertiary education builds on primary and secondary education and promotes development through expenditure, saving, and investment in subject-focused instruction. Education at this level fosters an environment that is conducive to innovation by creating a population that is more skilled at understanding and using financial products and services.

### 3.2.4. Industry-specific factors

We use the z-score as a proxy for bank efficiency. This measures and reflects the extent to which a bank can serve a diverse range of customers, including those who were previously unbanked but now have affordable and accessible financial services and products. For instance, a bank with a high z-score has a solid financial position and can provide a wide range of innovative financial services at competitive prices to low-income households and small businesses.

Gross capital formation (GCF) means net investment in physical assets, such as infrastructure, machinery, and buildings. High GCF is typically associated with investment in physical assets, indicating well-developed financial infrastructure (Encinas-Ferrer & Villegas-Zermeño, 2018). Hence, GCF could influence financial inclusion by creating an ecosystem that enables broader access to financial services.

### 3.2.5. Institutional factors

For this analysis, we use three key variables: political governance, tax governance, and effective trade protocols. We measure political governance using political stability as a proxy. Following Hurwitz (1973) and Kaufmann et al. (2011), we measure political stability to capture the continuity and predictability of governance, the absence of violence, governmental tenure, the existence of a legitimate

constitutional regime, the absence of structural change, and a multifaceted societal attribute. Hence, political stability increases investor confidence, broadening access to financial services and investment (Alhassan et al., 2021).

Tax governance refers to the structured, systemic, and authoritative mechanisms that regulate taxation. We measure tax governance using the level of the tax burden, which includes marginal tax rates on personal and corporate income and overall taxation levels. Tax governance can influence economic behavior, financial decisions, and income distribution, potentially impacting financial inclusion.

Lastly, we employ the measure of trade freedom as a proxy for effective trade protocols in a country. This economic institution establishes rules, policies, and protocols to oversee and manage a country's international trade activities. We measure effective trade protocols using the extent of tariff and nontariff barriers in a country's trade policy.

Appendix Tables A6 and A7 list the descriptive statistics of the variables for SSA and OECD countries. Some data points are missing for specific variables in the dataset because of data unavailability. The FII is standardized to a mean of zero and a standard deviation of one for both regions. Trade as a percentage of GDP is significantly higher in OECD countries than in SSA economies. Average trade as a percentage of GDP is 93.45 percent in OECD economies, whereas it is 67.13 percent in SSA economies. Average GDP per capita is US\$32,913.30 in OECD countries, much higher than in SSA economies, where it is only US\$1882.30, which shows that Africa is categorized as lower-middle income according to the World Bank range of US\$1036 to \$4085. Between 2000 and 2021, SSA experienced an average remittance inflow of 2.58 percent of GDP, whereas OECD countries had a low average, 0.89 percent. This highlights the significant role of remittances in the development of SSA countries.

## 4. Methodology

### 4.1. Model specification

To assess the factors that influence financial inclusion, we construct a panel empirical model, and, following Gebrehiwot and Makina (2019) and Le et al. (2019), we specify the model as a dynamic panel equation:

$$\begin{aligned} FII_{it} = & \beta_1 FII_{it-1} + \beta_2 REMIT_{it} + \beta_3 BE_{it} + \beta_4 LIT_{it} + \beta_5 INC_{it} + \beta_6 TO_{it} \\ & + \beta_7 INF_{it} + \beta_8 GOVT_{it} + \beta_9 GCF_{it} + \beta_{10} EMPLOY_{it} + \beta_{11} PG_{it} + \beta_{12} TAX_{it} \\ & + \beta_{13} ETP_{it} + \nu_i + \varepsilon_{it} \end{aligned} \quad (5)$$

in which FII is the Financial Inclusion Index,  $\nu$  represents the time-invariant, country-specific fixed effects, and  $\varepsilon$  is a disturbance term for the residual. The determinants are divided into:

- Macroeconomic factors: *INC* (Income), *EMPLOY* (Employment Rate), and *INF* (Inflation)
- Policy factors: *TO* (Trade Openness) and *GOVT* (Government Expenditure)
- Cultural and Socioeconomic factors: *REMIT* (Remittance inflows) and *LIT* (Literacy Rate)
- Industry-specific factors: *BE* (Bank Efficiency) and *GCF* (Gross Capital Formation)
- Institutional factors: *PG* (Political Governance), *TAX* (Tax Governance), and *ETP* (Effective Trade Protocol)

FII is the index of different disaggregated dimensions defined in Section 3.1; the determinants are defined in Section 3.2.

We then estimate the model with the time-fixed effects of COVID-19 and the GFC to capture the impact of these events on financial inclusion. We specify the model as follows:

<sup>4</sup> We do not use the human development index (HDI) as a proxy for the literacy rate as it is highly correlated with income. The statistical composite index already takes into account several factors, such as per capita income.

$$\begin{aligned}
FII_{it} = & \beta_1 FII_{it-1} + \beta_2 REMIT_{it} + \beta_3 BE_{it} + \beta_4 LIT_{it} + \beta_5 INC_{it} + \beta_6 TO_{it} \\
& + \beta_7 INF_{it} + \beta_8 GOVT_{it} + \beta_9 GCF_{it} + \beta_{10} EMPLOY_{it} + \beta_{11} PG_{it} + \beta_{12} TAX_{it} \\
& + \beta_{13} ETP_{it} + \beta_{14} CRISIS_t + \beta_{15} COVID_t + \nu_i + \epsilon_{it}
\end{aligned} \quad (6)$$

where *CRISIS* represents a time dummy that captures the GFC, and *COVID* represents a time dummy covering the period of COVID-19; the specification is estimated with each dummy separately.

In our robustness test, we re-estimate the model employing the different dimensions of financial inclusion as a proxy for our dependent variable. This approach assesses how the regressors independently impact the various dimensions of FII. We specify the model as follows:

$$\begin{aligned}
FID_{it} = & \beta_1 FID_{it-1} + \beta_2 REMIT_{it} + \beta_3 BE_{it} + \beta_4 LIT_{it} + \beta_5 INC_{it} + \beta_6 TO_{it} \\
& + \beta_7 INF_{it} + \beta_8 GOVT_{it} + \beta_9 GCF_{it} + \beta_{10} EMPLOY_{it} + \beta_{11} PG_{it} + \beta_{12} TAX_{it} \\
& + \beta_{13} ETP_{it} + \nu_i + \epsilon_{it}
\end{aligned} \quad (7)$$

where FID represents the various dimensions of financial inclusion, which are access, usage, and quality. Each of these dimensions is captured separately in the model and measured as described in Section 3.1.

#### 4.2. Estimation technique

In line with the literature on financial inclusion, we use the dynamic SGMM panel estimator to estimate the model while accounting for potential endogeneity. As specified in Equations (5) and (6), the lag in financial inclusion and several other basic factors drive the current level of financial inclusion. This autoregressive nature of financial inclusion is characterized by endogeneity due to its persistence over time (Law & Azman-Saini, 2012). Endogeneity can also occur when reverse causality arises among the independent variables, and reverse causality arise between the independent variable and financial inclusion.

Arellano and Bond (1991) and Blundell and Bond (1998) developed the SGMM estimation technique to address this issue. This estimation approach involves integrating the equations at level with those at first difference and using the differences in the lagged values of the independent variables as instruments in estimating the system of equations at level. Additionally, it addresses the issue of reverse causality between the regressor and regressands by separating the exogenous components from the endogenous variables or variables that are affected by simultaneity bias to avoid spurious estimation. Hence, using SGMM addresses the issues of simultaneity, identification, and exclusion restrictions.<sup>5</sup> These properties of the estimation technique justify using the lagged differences as instruments in the levels equation and instruments in the difference equation (Tchamyou & Asongu, 2017).

Because the dependent variable tends to persist over time, Agyei et al. (2020) recommend that the correlation coefficient between the response variable and its lagged value be at least 0.8000. This justifies the appropriateness of a dynamic model (two-step GMM), rather than a static one. Arellano and Bond (1991) suggest that the time-series dimension (T) of panel data be smaller than the cross-sectional dimension to prevent proliferation of instruments. In this study, for SSA countries T = 22 and N = 31 in the panel data, whereas, for OECD countries, T = 22 and N = 38.

<sup>5</sup> Simultaneity refers to the relationship among different variables; by accounting for it, we can ensure the accuracy and reliability of our findings. However, identification involves selecting the most relevant and causally impactful variables that drive the key factors. By establishing a strong exclusion restriction, the instrumental variables used affect the outcomes through the intended factors (Asongu & De Moor, 2017; Asongu et al., 2019; Tchamyou & Asongu, 2017).

The SGMM technique employs instruments to represent independent variables, and the validity of these instruments is evaluated using the Sargan test of overidentifying restrictions. This test determines whether the instruments are exogenous and thus valid. If the null hypothesis,  $\text{cov}(z_i, \epsilon_i) \neq 0$ , is rejected, then the exclusion restrictions for the instruments might not be adequate. Furthermore, we perform an Arellano and Bond serial correlation analysis to test for autocorrelation on the difference residuals using second-order AR (2) serial correlation. According to Mileva (2007), the null hypothesis,  $\text{cov}(\epsilon_i, z_i) = 0$ , of the test for AR (1) is expected to be rejected. However, the test for AR (2) is more important, because it detects autocorrelation at levels, and, therefore, its null hypothesis should not be rejected.

Following Asongu and De Moor (2017), we report on the four primary information criteria required to evaluate the validity of the estimated GMM models: (1) the null hypothesis of the second-order Arellano and Bond autocorrelation test AR (2) for the absence of autocorrelation in the residuals, (2) the Sargan and Hansen over-identifying restrictions (OIR) tests to assess whether the instruments are valid and correlated with the error terms, (3) the Difference in Hansen (DHT) test of exogeneity of the instruments to evaluate the results of the Hansen OIR test, and (4) the Fischer test of the joint validity of the estimated coefficients.

We use pairwise correlation to measure the direction and strength of the relationship between the variables, but they do not necessarily imply causality. We also examine the magnitude of the correlation coefficient for multicollinearity among the independent variables. The presence of multicollinearity can weaken the validity of regression estimations. The FII for OECD economies has a positive correlation with its lagged value, with a coefficient of 0.946. Likewise, in SSA, the FII has a correlation coefficient of 0.986 with its lagged value. The magnitude of these relationships indicates a high level of persistence in financial inclusion and justifies the use of SGMM. Based on the results in Appendix Tables A8 and A9, multicollinearity presents no significant concerns in the model specification. The independent variables have a correlation coefficient of less than 0.7 (Krehbiel, 2004).

#### 4.3. Diagnostics test of the models

The results of the Sargan and Hansen tests that test the instruments' validity are insignificant ( $p > 0.1$ ). So, the null hypothesis of exogeneity can be rejected for the instruments, meaning that the instruments reported in our results are valid. Also, we fail to reject the null hypothesis of no autocorrelation at a significant level, as the  $p$ -values of AR (2) are all higher than 10 percent ( $p > 0.1$ ). The absence of instrument proliferation and autocorrelation suggests that the findings in Section 5 are reliable and conclusive.

#### 4.4. Unit-root test

We assess the stationarity of our data using an adequate panel unit-root test. Because of the unbalanced nature of our panel dataset, the most suitable test is the Fisher-adjusted Dickey-Fuller (ADF) test (Abeka et al., 2021; Choi, 2001) because other tests do not support an unbalanced dataset. The Fisher-ADF test assumes a null hypothesis of a unit root across all panels and an alternative hypothesis of its absence. Our findings in Appendix Tables A10 and A11 detail the unit-root test results for SSA and OECD variables as ratios.

Based on the test results, we can reject the null hypothesis of a unit root in all panels at conventional levels. Abeka et al. (2021) recommend the use of the reverse normal Z-statistic, as it provides an optimal balance between size and power, and it shows strong evidence of stationarity in all the variables. Hence, the data are stationary, and the estimation is reliable.

## 5. Results and discussion

Tables 1 and 2 give the results of the explanatory variables, grouped into cultural and socioeconomic, policy, institutional, macroeconomic, and industry-specific factors, for the SSA and OECD economies, respectively.

### 5.1. Determinants of financial inclusion in SSA

#### 5.1.1. Cultural and socioeconomic factors

We examine the impact of the literacy rate on financial inclusion in SSA. Our analysis identifies a significantly positive contribution of the literacy rate to financial inclusion, indicating that an effective education

system is essential for promoting higher levels of financial inclusion in SSA. Through a combination of awareness, knowledge, skill, and attitude, this effect leads people to make sound financial decisions (Ha et al., 2023). Hence, literacy affects people's financial behavior, leading to higher savings rates, deposit accumulation, use of financial products, and investment. The results support the findings by Akudugu (2013) and Chikalipah (2017). Our empirical evidence confirms the conclusion that illiteracy significantly explains low financial inclusion in the region (Ray et al., 2022).

Next, we check the effect of remittances on the level of financial inclusion in SSA and find that it has a negative but significant influence on financial inclusion. This finding can be attributed to the increasing adoption of various remittance channels. This proliferation has resulted

**Table 2**

Determinants of financial inclusion in the OECD countries.

|                                          | OECD                           | GFC                            | COVID-19                       |
|------------------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Lagged financial inclusion index (L.FII) | 0.995 <sup>a</sup><br>(0.023)  | 0.942 <sup>a</sup><br>(0.030)  | 0.952 <sup>a</sup><br>(0.025)  |
| Cultural and socioeconomic factors       |                                |                                |                                |
| Literacy rate                            | −1.789 <sup>c</sup><br>(0.766) | −4.752 <sup>a</sup><br>(0.658) | −3.513 <sup>a</sup><br>(0.432) |
| Remittance                               | 0.067 <sup>b</sup><br>(0.020)  | 0.121 <sup>a</sup><br>(0.033)  | 0.077 <sup>a</sup><br>(0.018)  |
| Policy factors                           |                                |                                |                                |
| Trade openness                           | −0.001<br>(0.000)              | −0.002 <sup>a</sup><br>(0.000) | −0.001 <sup>b</sup><br>(0.000) |
| Government expenditure (GE)              | −0.003<br>(0.007)              | 0.009<br>(0.010)               | −0.003<br>(0.006)              |
| Institutional factors                    |                                |                                |                                |
| Political governance                     | 0.003<br>(0.049)               | 0.107 <sup>c</sup><br>(0.050)  | 0.103 <sup>a</sup><br>(0.020)  |
| Tax governance                           | −0.008 <sup>a</sup><br>(0.002) | −0.004<br>(0.002)              | −0.003 <sup>a</sup><br>(0.001) |
| Effective trade protocol                 | 0.005 <sup>c</sup><br>(0.002)  | 0.011 <sup>c</sup><br>(0.005)  | −0.002<br>(0.002)              |
| Macroeconomic factors                    |                                |                                |                                |
| Income                                   | 0.006 <sup>b</sup><br>(0.002)  | −0.007 <sup>c</sup><br>(0.003) | 0.003<br>(0.002)               |
| Inflation                                | 0.052 <sup>a</sup><br>(0.008)  | 0.009<br>(0.010)               | 0.014 <sup>c</sup><br>(0.006)  |
| Employment                               | 0.008 <sup>b</sup><br>(0.003)  | −0.007<br>(0.004)              | −0.008 <sup>a</sup><br>(0.002) |
| Industry-specific factors                |                                |                                |                                |
| Bank efficiency                          | 0.007 <sup>c</sup><br>(0.003)  | 0.006 <sup>b</sup><br>(0.002)  | 0.004 <sup>c</sup><br>(0.002)  |
| Gross capital formation (GCF)            | 0.025 <sup>a</sup><br>(0.005)  | 0.023 <sup>a</sup><br>(0.005)  | 0.025 <sup>a</sup><br>(0.005)  |
| Time-fixed effects                       |                                |                                |                                |
| Global financial crisis                  |                                | 0.076 <sup>b</sup><br>(0.026)  |                                |
| COVID-19                                 |                                |                                | −0.138 <sup>a</sup><br>(0.017) |
| Constant                                 | 0.625<br>(0.540)               | 3.798 <sup>a</sup><br>(0.841)  | 3.686 <sup>a</sup><br>(0.528)  |
| Diagnostics                              |                                |                                |                                |
| Fisher                                   | 60,217.81                      | 6301.66                        | 25,060.77                      |
| Prob. (Wald)                             | 0.000                          | 0.000                          | 0.000                          |
| AR1 (p-value)                            | 0.000                          | 0.001                          | 0.001                          |
| AR2 (p-value)                            | 0.159                          | 0.223                          | 0.281                          |
| Hansen-J OIR (p-value)                   | 0.627                          | 0.261                          | 0.239                          |
| Sargan OIR (p-value)                     | 0.214                          | 0.316                          | 0.103                          |
| DHT for instrument                       |                                |                                |                                |
| Instruments at levels                    |                                |                                |                                |
| H Excluding group                        | 0.225                          | 0.034                          | 0.532                          |
| Dif (null, H = exogenous)                | 0.791                          | 0.615                          | 0.180                          |
| IV (years, eq (diff))                    |                                |                                |                                |
| H excluding group                        | 0.591                          | 0.331                          | 0.309                          |
| Dif (null, H = exogenous)                | 0.549                          | 0.118                          | 0.104                          |
| Observations                             | 485                            | 485                            | 485                            |

Notes: Statistical significance.

<sup>a</sup> 0.1%.

<sup>b</sup> 1%, and.

<sup>c</sup> 5%. Standard errors are in parentheses.

in a new form of financial exclusion, specifically for less digitally literate users. Remittances are usually the first financial service that migrants employ to provide for their families and friends. Hence, steady remittance inflows can offer recipient households an alternative source of financing, potentially at the expense of the formal financial market, represented mainly by banking institutions (Bangake et al., 2021).

Additionally, it is common in SSA for remittances to be transmitted by travelers or unregulated alternatives because they have low costs for foreign exchange conversion. The policy window might encourage the use of modern, user-friendly technology for remittances (Misati et al., 2019). According to Misati et al. (2019), commercial banks might find it useful to increase their innovative products tailored for migrants in order to boost deposit reserves. This approach could involve introducing attractive incentives, such as higher interest rates on remittance-based deposits and considering regular remittance flows as collateral for credit allocation.

### 5.1.2. Policy factors

Trade openness is found to improve financial inclusion levels in SSA, which suggests that, as SSA countries become more open to trade, their levels of financial inclusion rise. Trade openness attracts foreign competitors to the domestic market. The prevalence of trade competition decreases earnings and internal cash flows, forcing firms to rely on financing from domestic banks, capital markets, or external funding (Fu et al., 2020; Rajan & Zingales, 2003). Trade openness drives innovation and pushes local banks to expand their services to previously underserved populations and cater to new and huge trade activities. This kind of competition and innovation increases the number of mobile phones and the penetration of mobile money in African countries, with a positive effect on financial inclusion (Andrianaivo & Kpodar, 2012).

Also, the effect of government expenditure is that it tends to decrease financial inclusion in SSA. High government expenditure might crowd out private sector investment, including investment in financial services. This effect is observed in SSA countries. For instance, Ngeendepi and Phiri (2021) find that government expenditure has a negative impact on private domestic investment in SSA, which could indirectly affect financial inclusion efforts by the private sector. However, it might depend on precisely where the government directs the expenditure (Omitogun, 2018).

### 5.1.3. Institutional factors

We show that improvement in political governance through political stability makes a positive contribution to increases in the level of financial inclusion in SSA. This result shows that a stable political environment is required for fostering greater financial inclusion in SSA. Alhassan et al. (2021) argue that when people trust that political conditions will remain stable in the region, they are more likely to engage in long-term financial planning and investment, such as opening bank accounts, purchasing insurance, and applying for loans.

Our results further suggest that tax governance, as measured by the tax burden, might not be the main determinant of financial inclusion in the region. SSA is characterized by a large informal sector, which often operates outside the formal tax system. This high level of informality might dilute the impact of the tax burden on financial inclusion, as a significant portion of economic activity and financial transactions occur outside the formal financial system. Also, the insignificant effect might be due in part to difficulties based on institutional weakness, which can affect the effectiveness of tax policies.

Furthermore, our results indicate that the effective tax protocols of open market institutions, measured as trade freedom, positively influence financial inclusion levels. These results suggest that economic institutions that promote trade freedom help achieve financial inclusion, potentially by facilitating cross-border transactions and reducing access barriers to financial services. These findings are consistent with those by Shkolnyk et al. (2020).

### 5.1.4. Macroeconomic factors

Our results also highlight the impact of income measured by GDP per capita on financial inclusion in SSA economies. We find that higher income levels tend to decrease financial inclusion. This finding could be intuitive based on the structure of the financial sector in many SSA countries. Banks and other formal financial institutions might focus on high-net-worth individuals or corporate clients, neglecting the needs of the broader population, rural population, and informal sectors. However, a large share of income is held by a small group. A large share of the countries' income is generated by the informal sector.

We show that inflation does not have a significant impact on financial inclusion. This finding is similar to that by Alber (2019) and Evans and Adeoye (2016), who find an insignificant impact of inflation on the level of financial inclusion.

Further, we note that financial inclusion is not influenced by employment. These findings might be explained by the nature of employment in SSA, which is predominated by informal employment and may not necessarily lead to greater financial inclusion.

### 5.1.5. Industry-specific factors

We further show that bank efficiency significantly increases financial inclusion in SSA. This finding can be attributed to the optimization and reduction of operating costs, enabling banks to offer services at lower prices and extend their reach to previously unprofitable market segments. According to Agarwala et al. (2023), it is crucial to maximize all available resources in order to ensure universal access to financial services. This finding also highlights the intention of the banking sector in SSA countries to operate innovatively and efficiently without political influence.

In SSA economies, GCF has a negative effect on financial inclusion. This negative effect is demonstrated by the prioritization of investment in physical assets over investment in financial inclusion programs.

## 5.2. Determinants of financial inclusion in OECD economies

### 5.2.1. Cultural and socioeconomic factors

Having confirmed a significantly positive connection between literacy and financial inclusion in SSA economies, we next document the contrasting influence of literacy on financial inclusion in the OECD countries. Based on the results in Table 2, our analysis indicates that, in OECD countries, the coefficient of the effect of the literacy rate on financial inclusion is negative. Hence, high literacy rates could create barriers to financial inclusion by influencing behavior, perceptions, and attitudes toward financial products and institutions. The empirical evidence in studies on advanced countries indicates that financial literacy creates sufficient knowledge for comparing financial products, making financial decisions, and improving access to financial services and benefits (Grohmann et al., 2018; Ray et al., 2022). However, higher literacy could lead people to overestimate their financial abilities, leading them to overlook or dismiss certain financial services, products, or advice.

Moreover, in advanced countries such as the members of the OECD, financial services might be designed assuming a certain level of financial literacy, which could make them more complex, intimidating, and inaccessible. We call this a sophistication bias. Because of advancements in the financial market, which offers a plethora of products and information, choices are abundant because of increased literacy, which leads to decision paralysis, confusion, and decisions to opt out of engagement with financial services. According to Hasan et al. (2021), financial literacy alone might not influence financial inclusion, but combining financial literacy with the internet or financial stability could improve financial access.

Regarding remittance inflows in OECD countries, we highlight that remittances are associated with improving financial inclusion, in contrast to the trends observed in SSA. Recent evidence suggests that remittances typically flow from high-income economies and are usually

used by migrants (Anzoategui et al., 2014). According to a report by the International Fund for Agricultural Development (IFAD) and the World Bank (2015), foreign remittances sent from OECD countries are typically sent more frequently than those from SSA (on average 11 times a year) and for larger sums per transactions (on average US\$200 to US\$300 per transaction). Ardiç et al. (2022) state that most migrants who send remittances from OECD countries have bank accounts, often used for depositing paychecks, paying bills, and making transfers. This demonstrates the significance in its effect on financial inclusion levels in OECD countries. However, Kokorović Jukan et al. (2020) posit that in South-East Europe, most transfers are paid in cash, which deters the saving (i.e., depositing in a savings account at a bank) of excess remittances. However, this tendency has been altered by the development of financial products, such as online banking and mobile transfer applications.

### 5.2.2. Policy factors

Trade openness is found to be irrelevant to financial inclusion in OECD countries. Because of globalization and the integration of most OECD economies, they have homogeneous trade structures. This is primarily evident in Europe. When countries in a particular region have similar trade structures or patterns, the impact of trade openness on financial inclusion might not be very different. Likewise, countries with similar regulatory environments with respect to trade might also experience similar impacts on financial inclusion from trade openness.

Our analysis also shows that government expenditure has an insignificant effect on financial inclusion. Perhaps the impact of government expenditure on financial inclusion takes time to materialize and is subject to a time lag. Another perspective to consider is the efficiency of government expenditure. Honohan (2008) emphasizes that the effectiveness of government spending in promoting financial inclusion depends heavily on its allocation and efficiency. It is possible that, in OECD countries, the allocation of government expenditure might not be optimally targeted at enhancing financial inclusion.

### 5.2.3. Institutional factors

Our estimation results on the impact of political governance, which explains the level of political stability, show that political stability has an insignificant effect on financial inclusion in OECD countries. This outcome is not surprising, as after a certain level of political stability is attained, marginal stability improvements are likely to have minimal impacts on the already high level of financial inclusion, as evidenced by the insignificant coefficient.

Tax governance, which explains the level of the tax burden, has a negative influence on financial inclusion in OECD countries. The negative effect is evident because having higher tax burdens may hinder financial inclusion by reducing disposable income and increasing the cost of financial transactions.

Our findings on OECD countries, like those for SSA, show that effective trade protocols contribute to improvement in financial inclusion. As an institutional variable, effective trade protocols reflect trade freedom and the regulatory environment for international trade, which might facilitate financial innovation and improve financial services and products.

### 5.2.4. Macroeconomic factors

The results in Table 2 confirm that higher income levels improve financial inclusion in OECD countries. Higher incomes provide more disposable income, which enables individuals to save and invest in various financial instruments, thus fostering financial inclusion (Le et al., 2019). This result highlights the importance of high-income countries in advancing financial inclusion. Moreover, higher-income individuals generally have better credit profiles, enhancing their eligibility for loans and credit and promoting financial inclusion. Our findings are consistent with those by Tsouli (2022) and Wang and Guan (2017), who assert that financial inclusion tends to be higher in

developed European and North American countries than in less developed countries, and individual income plays a pivotal role.

Further, we find that inflation has a positive effect on SSA economies. Although we do not test the threshold effects, this finding suggests that accommodating some level of inflation can be important in promoting financial inclusion. According to Phillips (1958) and Shukayev and Ueberfeldt (2018), maintaining a moderate inflation level, typically between 2% and 4% annually (Blanchard et al., 2010), promotes full financial stability and development, as inflation can positively affect financial inclusion.

Our estimation results reveal a significant link between employment rates and improved financial inclusion in OECD countries. This finding is consistent with prior literature and economic theory, which suggest that higher employment rates enhance financial inclusion outcomes. Employment gives people a steady income stream, which is often a prerequisite to formal financial services (Demirgüç-Kunt, 2018). Additionally, many employers in OECD countries pay wages through direct deposit, requiring employees to have bank accounts. Consequently, in countries where wages are more likely to be deposited into bank accounts, account ownership tends to be higher (Allen et al., 2016). Employment also enhances creditworthiness, facilitating access to credit and further contributing to financial inclusion (Brown et al., 2011).

### 5.2.5. Industry-specific factors

Our estimation results show that bank efficiency makes a positive contribution to financial inclusion in OECD countries. This outcome is not surprising and expected, as bank efficiency is connected to the performance of the financial system. These underlying conditions boost accessibility and the use of financial products and services. Some evidence also suggests that bank efficiency contributes to the creation and adoption of financial institutions and financial services by individuals (Tiwari et al., 2019; Wang & Guan, 2017).

We also show that GCF is associated with higher financial inclusion levels in OECD countries. Higher GCF often indicates higher investment in infrastructure, including financial infrastructure, such as ATMs, bank branches, and digital payment systems. This improved infrastructure can enhance financial inclusion through increased access to financial services. These findings align with those by Demirgüç-Kunt and Klapper (2013), who observe that, in high-income economies, the availability of financial infrastructure significantly influences the use of formal financial services.

## 5.3. The effect of the GFC and COVID-19 on financial inclusion in SSA and the OECD

Our study period covers a lengthy period of financial development and certain events that entailed some financial distress, including the GFC and the COVID-19 pandemic.<sup>6</sup> These global events transcended geographic barriers. Accounting for them helps clarify their regional impact, which contributes to global knowledge. These events also help us explain the impact of globalization on financial inclusion and make policy recommendations for capitalizing on globalization in order to boost financial inclusion. Hence, we examine these events and present our test results in Tables 1 and 2

The results on SSA are in Table 1. Our analysis shows that the GFC

<sup>6</sup> In one of our supplementary test estimations for SSA and OECD countries, we also account for the cryptocurrency phenomenon. We observe that the emergence of cryptocurrency has a negative effect on financial inclusion in both regions. In countries with limited technological development, adopting cryptocurrency could hinder access to these financial tools and products. Likewise, cryptocurrency operates on complex technological platforms, which primarily rely on blockchain technology. This complexity might deter less tech-savvy individuals or those unfamiliar with the technology, such as the elderly, from participating, thereby limiting their financial inclusion (Bui & Luong, 2023).

had a negative influence on financial inclusion levels in SSA. These results align with several prior studies. Beck et al. (2011) find that the 2008 financial crisis reduced access to financial services in developing countries, including those in SSA, with a significant effect due to reduced remittance flows, lower capital and portfolio flows, cross-border bank flows and FDI, which affected financial inclusion. Adeola and Evans (2017) note that banks tend to tighten their lending standards, disproportionately affecting low-income individuals and small businesses, which are key targets for financial inclusion efforts.

Similarly, we found that COVID-19 had an insignificant effect on financial inclusion in SSA. Our findings might be due to the different financial structures in the region. SSA economies often have unique financial structures dominated by informal sectors. These sectors might have been impacted by the crisis less than formal financial systems, influencing the overall impact on financial inclusion. Financial innovation is the best tool for developing innovative financial products that cater to the needs of all sectors, leveraging their unique characteristics

**Table 3**

Robustness Test: Determinants of financial inclusion dimensions in SSA.

|                                          | Access                         | Usage                          | Quality                        |
|------------------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Lag of financial inclusion index (L.FII) | 0.929 <sup>a</sup><br>(0.052)  | 0.959 <sup>a</sup><br>(0.016)  | 0.928 <sup>a</sup><br>(0.062)  |
| Cultural and socioeconomic factors       |                                |                                |                                |
| Literacy rate                            | −0.286<br>(0.723)              | −0.206<br>(0.119)              | −0.047<br>(0.300)              |
| Remittance                               | −0.132 <sup>a</sup><br>(0.025) | 0.014 <sup>b</sup><br>(0.005)  | 0.039 <sup>a</sup><br>(0.010)  |
| Policy factors                           |                                |                                |                                |
| Trade openness                           | −0.005<br>(0.003)              | 0.001 <sup>c</sup><br>(0.001)  | 0.005 <sup>b</sup><br>(0.002)  |
| Government expenditure (GE)              | −0.004 <sup>c</sup><br>(0.002) | 0.000 <sup>c</sup><br>(0.000)  | −0.002 <sup>a</sup><br>(0.000) |
| Institutional factors                    |                                |                                |                                |
| Political governance                     | 0.198 <sup>c</sup><br>(0.081)  | 0.056 <sup>a</sup><br>(0.013)  | 0.117 <sup>c</sup><br>(0.057)  |
| Tax governance                           | 0.023 <sup>b</sup><br>(0.009)  | 0.008 <sup>a</sup><br>(0.002)  | 0.002<br>(0.005)               |
| Effective trade protocol                 | −0.008<br>(0.005)              | −0.004 <sup>b</sup><br>(0.001) | −0.008 <sup>a</sup><br>(0.002) |
| Macroeconomic factors                    |                                |                                |                                |
| Income                                   | −0.022 <sup>b</sup><br>(0.007) | 0.006 <sup>b</sup><br>(0.002)  | 0.013 <sup>c</sup><br>(0.005)  |
| Inflation                                | −0.026<br>(0.015)              | −0.017 <sup>a</sup><br>(0.002) | −0.006<br>(0.004)              |
| Employment                               | −0.010<br>(0.007)              | −0.002<br>(0.002)              | 0.007 <sup>c</sup><br>(0.003)  |
| Industry-specific factors                |                                |                                |                                |
| Bank efficiency                          | 0.062 <sup>b</sup><br>(0.021)  | 0.003<br>(0.003)               | 0.015 <sup>b</sup><br>(0.005)  |
| Gross capital formation (GCF)            | 0.013 <sup>c</sup><br>(0.006)  | −0.005 <sup>b</sup><br>(0.002) | −0.008 <sup>c</sup><br>(0.004) |
| Constant                                 | −0.376<br>(1.051)              | 0.049<br>(0.256)               | −0.401<br>(0.337)              |
| Diagnostics                              |                                |                                |                                |
| Fisher                                   | 21,232.16                      | 28,285.13                      | 35,701.77                      |
| Prob. (Wald)                             | 0.000                          | 0.000                          | 0.000                          |
| AR1 (p-value)                            | 0.029                          | 0.055                          | 0.024                          |
| AR2 (p-value)                            | 0.196                          | 0.628                          | 0.719                          |
| Hansen-J OIR (p-value)                   | 0.981                          | 0.936                          | 0.948                          |
| Sargan OIR (p-value)                     | 0.135                          | 0.862                          | 0.511                          |
| DHT for instrument                       |                                |                                |                                |
| Instruments in levels                    |                                |                                |                                |
| H Excluding group                        | 0.396                          | 0.850                          | 0.615                          |
| Dif (null, H = exogenous)                | 0.989                          | 0.866                          | 0.941                          |
| IV (years, eq (diff))                    |                                |                                |                                |
| H excluding group                        | 0.969                          | 0.919                          | 0.845                          |
| Dif (null, H = exogenous)                | 0.866                          | 0.638                          | 1.000                          |
| Observations                             | 226                            | 308                            | 268                            |

Notes: Statistical significance.

<sup>a</sup> 0.1%.<sup>b</sup> 1%, and.<sup>c</sup> 5%. Standard errors are in parentheses.**Table 4**

Determinants of financial inclusion dimensions in OECD countries.

|                                          | Access                         | Usage                          | Quality                        |
|------------------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Lagged financial inclusion index (L.FII) | 0.968 <sup>a</sup><br>(0.007)  | 0.982 <sup>a</sup><br>(0.034)  | 0.826 <sup>a</sup><br>(0.066)  |
| Cultural and socioeconomic factors       |                                |                                |                                |
| Literacy rate                            | −0.254<br>(0.181)              | −4.115 <sup>b</sup><br>(1.227) | −5.754 <sup>a</sup><br>(1.386) |
| Remittance                               | 0.018 <sup>b</sup><br>(0.005)  | 0.127 <sup>a</sup><br>(0.025)  | −0.187 <sup>b</sup><br>(0.066) |
| Policy factors                           |                                |                                |                                |
| Trade openness                           | 0.000 <sup>b</sup><br>(0.000)  | 0.000<br>(0.001)               | 0.002 <sup>c</sup><br>(0.001)  |
| Government expenditure (GE)              | 0.004 <sup>a</sup><br>(0.001)  | 0.025<br>(0.014)               | 0.028 <sup>c</sup><br>(0.013)  |
| Institutional factors                    |                                |                                |                                |
| Political governance                     | 0.022 <sup>b</sup><br>(0.009)  | −0.027<br>(0.060)              | 0.133<br>(0.067)               |
| Tax governance                           | 0.000<br>(0.000)               | −0.008 <sup>c</sup><br>(0.003) | 0.004<br>(0.003)               |
| Effective trade protocol                 | −0.003 <sup>a</sup><br>(0.001) | 0.011 <sup>b</sup><br>(0.003)  | −0.056 <sup>a</sup><br>(0.006) |
| Macroeconomic factors                    |                                |                                |                                |
| Income                                   | −0.001 <sup>c</sup><br>(0.001) | −0.013<br>(0.007)              | −0.023 <sup>a</sup><br>(0.004) |
| Inflation                                | 0.006 <sup>a</sup><br>(0.001)  | 0.040 <sup>a</sup><br>(0.011)  | −0.045 <sup>b</sup><br>(0.014) |
| Employment                               | 0.000<br>(0.001)               | 0.006<br>(0.006)               | −0.055 <sup>a</sup><br>(0.011) |
| Industry-specific factors                |                                |                                |                                |
| Bank efficiency                          | −0.001 <sup>c</sup><br>(0.000) | −0.004<br>(0.003)              | 0.035 <sup>a</sup><br>(0.007)  |
| Gross capital formation (GCF)            | −0.002 <sup>a</sup><br>(0.001) | 0.029 <sup>a</sup><br>(0.007)  | −0.053 <sup>a</sup><br>(0.007) |
| Constant                                 | 0.546 <sup>b</sup><br>(0.161)  | 2.486 <sup>c</sup><br>(1.071)  | 13.857 <sup>a</sup><br>(1.632) |
| Diagnostics                              |                                |                                |                                |
| Fisher                                   | 243,247.68                     | 324.61                         | 265.89                         |
| Prob. (Wald)                             | 0.000                          | 0.000                          | 0.000                          |
| AR1 (p-value)                            | 0.177                          | 0.002                          | 0.170                          |
| AR2 (p-value)                            | 0.327                          | 0.105                          | 0.243                          |
| Hansen-J OIR (p-value)                   | 0.597                          | 0.682                          | 0.748                          |
| Sargan OIR (p-value)                     | 0.645                          | 0.655                          | 0.403                          |
| DHT for instrument                       |                                |                                |                                |
| Instruments in levels                    |                                |                                |                                |
| H Excluding group                        | 0.149                          | 0.760                          | 0.881                          |
| Dif (null, H = exogenous)                | 0.835                          | 0.548                          | 0.545                          |
| IV (years, eq (diff))                    |                                |                                |                                |
| H excluding group                        | 0.544                          | 0.912                          | 0.749                          |
| Dif (null, H = exogenous)                | 0.776                          | 0.022                          | 0.335                          |
| Observations                             | 522                            | 599                            | 634                            |

Notes: Statistical significance.

<sup>a</sup> 0.1%.<sup>b</sup> 1%, and.<sup>c</sup> 5%. Standard errors are in parentheses.

and preferences for better inclusion. According to Verick (2006), these financial innovation tools aim to improve information inflow, access to credit and insurance for businesses, and cross-border payment systems. Alternatively, many SSA countries faced financial exclusion challenges before these events.

The findings on the OECD countries are in Table 2. In the OECD countries, unlike in SSA, the GFC made a small but positive contribution to financial inclusion. This result might initially seem counterintuitive, but Philippon (2016) discusses how the crisis spurred financial innovation, particularly in financial technology (fintech). This innovation may have led to new financial products and services that improved access for previously underserved populations. Further, this crisis led to significant regulatory reforms in many OECD countries. The postcrisis regulations, though aimed primarily at making the financial sector more secure (Claessens & Rojas-Suarez, 2016; Philippon, 2016), also had positive spillover effects on financial inclusion. It improved consumer protection and transparency measures, which may have increased trust

**Table 5**

Determinants of financial inclusion in SSA (single indicators).

|                                          | ATMs                           | Bank branches                  | Bank deposits                  | Bank credit to deposits        | Life insurance    | Non-life insurance             |
|------------------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------|--------------------------------|
| Lagged financial inclusion index (L.FII) | 0.787 <sup>a</sup><br>(0.024)  | 0.855 <sup>a</sup><br>(0.033)  | 0.929 <sup>a</sup><br>(0.039)  | 0.974 <sup>a</sup><br>(0.061)  | 0.994<br>(0.010)  | 0.867 <sup>a</sup><br>(0.076)  |
| Cultural and socioeconomic factors       |                                |                                |                                |                                |                   |                                |
| Literacy rate                            | −2.039 <sup>b</sup><br>(0.582) | −0.096<br>(2.867)              | −0.047<br>(0.101)              | −1.043 <sup>a</sup><br>(0.260) | 0.000<br>(0.131)  | −0.435<br>(0.530)              |
| Remittance                               | 0.043<br>(0.022)               | −0.358 <sup>a</sup><br>(0.098) | 0.022 <sup>a</sup><br>(0.006)  | −0.018<br>(0.013)              | −0.008<br>(0.008) | −0.040 <sup>c</sup><br>(0.019) |
| Policy factors                           |                                |                                |                                |                                |                   |                                |
| Trade openness                           | −0.012 <sup>a</sup><br>(0.003) | −0.016<br>(0.016)              | 0.001<br>(0.001)               | 0.001<br>(0.001)               | 0.000<br>(0.000)  | 0.005<br>(0.002)               |
| Government expenditure (GE)              | −0.002<br>(0.003)              | −0.040 <sup>b</sup><br>(0.012) | 0.001 <sup>b</sup><br>(0.000)  | 0.000<br>(0.000)               | −0.001<br>(0.000) | −0.002 <sup>a</sup><br>(0.000) |
| Institutional factors                    |                                |                                |                                |                                |                   |                                |
| Political governance                     | 0.105<br>(0.132)               | −0.045<br>(0.382)              | 0.055 <sup>c</sup><br>(0.023)  | 0.149 <sup>b</sup><br>(0.050)  | 0.035<br>(0.009)  | −0.281 <sup>b</sup><br>(0.086) |
| Tax governance                           | −0.008<br>(0.008)              | −0.084 <sup>b</sup><br>(0.028) | 0.004 <sup>c</sup><br>(0.002)  | 0.015 <sup>c</sup><br>(0.006)  | 0.004<br>(0.001)  | −0.014 <sup>c</sup><br>(0.006) |
| Effective trade protocol                 | 0.013 <sup>c</sup><br>(0.006)  | 0.044<br>(0.029)               | −0.001<br>(0.002)              | −0.005<br>(0.004)              | −0.003<br>(0.001) | 0.004<br>(0.004)               |
| Macroeconomic factors                    |                                |                                |                                |                                |                   |                                |
| Income                                   | 0.049 <sup>a</sup><br>(0.010)  | −0.280 <sup>a</sup><br>(0.056) | 0.009 <sup>c</sup><br>(0.004)  | 0.008<br>(0.008)               | −0.005<br>(0.003) | 0.004<br>(0.009)               |
| Inflation                                | −0.003<br>(0.013)              | −0.079<br>(0.044)              | −0.014 <sup>a</sup><br>(0.002) | 0.014 <sup>b</sup><br>(0.004)  | −0.003<br>(0.002) | −0.020 <sup>a</sup><br>(0.005) |
| Employment                               | −0.019 <sup>c</sup><br>(0.009) | −0.150 <sup>a</sup><br>(0.018) | −0.005<br>(0.003)              | 0.006 <sup>c</sup><br>(0.003)  | 0.004<br>(0.002)  | −0.036 <sup>a</sup><br>(0.007) |
| Industry-specific factors                |                                |                                |                                |                                |                   |                                |
| Banks' efficiency                        | −0.009<br>(0.014)              | −0.052<br>(0.054)              | −0.003<br>(0.003)              | 0.043 <sup>a</sup><br>(0.010)  | −0.001<br>(0.003) | 0.061 <sup>a</sup><br>(0.007)  |
| Gross capital formation (GCF)            | 0.032 <sup>b</sup><br>(0.010)  | 0.168 <sup>b</sup><br>(0.050)  | −0.004 <sup>c</sup><br>(0.002) | 0.017 <sup>b</sup><br>(0.005)  | 0.001<br>(0.002)  | 0.005<br>(0.010)               |
| Constant                                 | 2.887 <sup>a</sup><br>(0.467)  | 14.277 <sup>a</sup><br>(3.154) | 0.218<br>(0.157)               | −1.211 <sup>b</sup><br>(0.417) | −0.345<br>(0.114) | 2.309 <sup>a</sup><br>(0.632)  |
| Diagnostics                              |                                |                                |                                |                                |                   |                                |
| Fisher                                   | 5403.27                        | 12,737.68                      | 8639.40                        | 1378.76                        | 108,507.27        | 4474.72                        |
| Prob. (Wald)                             | 0.000                          | 0.000                          | 0.000                          | 0.000                          | 0.000             | 0.000                          |
| AR1 (p-value)                            | 0.047                          | 0.015                          | 0.074                          | 0.000                          | 0.906             | 0.018                          |
| AR2 (p-value)                            | 0.424                          | 0.241                          | 0.980                          | 0.572                          | 0.336             | 0.658                          |
| Hansen-J OIR (p-value)                   | 0.322                          | 0.908                          | 0.900                          | 0.924                          | 0.978             | 0.953                          |
| Sargan OIR (p-value)                     | 0.770                          | 0.159                          | 0.908                          | 0.335                          | 0.906             | 0.509                          |
| DHT for instrument                       |                                |                                |                                |                                |                   |                                |
| Instruments in levels                    |                                |                                |                                |                                |                   |                                |
| H Excluding group                        |                                | 0.488                          | 0.293                          | 0.814                          | 0.492             | 0.506                          |
| Dif (null, H = exogenous)                | 0.770                          | 0.904                          | 0.973                          | 0.848                          | 0.988             | 0.972                          |
| IV (years, eq (diff))                    |                                |                                |                                |                                |                   |                                |
| H excluding group                        | 0.716                          | 0.789                          | 0.920                          | 0.918                          | 0.988             | 0.983                          |
| Dif (null, H = exogenous)                | 0.642                          | 1.000                          | 0.237                          | 0.450                          | 0.213             | 0.101                          |
| Observations                             | 226                            | 257                            | 308                            | 308                            | 268               | 286                            |

Notes: Statistical significance.

<sup>a</sup> 0.1%.<sup>b</sup> 1%, and.<sup>c</sup> 5%. Standard errors are in parentheses.

in financial institutions.

The results on the impact of COVID-19 on financial inclusion were also similar in both regions. Our analysis reveals that COVID-19 had a significantly negative effect. In response to its surge, many bank branches closed and services were reduced, which could have disproportionately affected those who rely on in-person banking services (Kuc-Czarnecka, 2020). Because of uncertainty, people might have become cautious about investing in or engaging with financial products, reducing their participation in the formal financial system.

## 6. Robustness tests

In addition to our baseline estimation, we perform various robustness checks to confirm the validity of our results and determine whether, and the extent to which, an indicator has differential effects on financial inclusion. We re-estimate the results for the different dimensions of financial inclusion, access, usage, and quality. We then adopt the various

indicators of financial inclusion described in Section 3.1 as a measure of financial inclusion, instead of using weighted variables. The results of our robustness test are in Tables 3–6.

### 6.1. Robustness test 1: the determinants of financial inclusion dimensions

First, we re-estimate the model using various dimensions of financial inclusion as a proxy variable. We first discuss the results for SSA (Table 3) and then the results for OECD countries (Table 4).

#### 6.1.1. Determinants of financial inclusion dimensions in SSA countries

**6.1.1.1. Cultural and socioeconomic factors.** We show that the literacy rate does not significantly impact financial inclusion levels in SSA. The results show that remittances have a negative impact on access but positive impacts on usage and quality. This mixed effect partially aligns with the findings by Anzoategui et al. (2014), in which that remittances

**Table 6**  
Determinants of financial inclusion in OECD countries (single indicators).

|                                          | ATMs                           | Bank branches                  | Bank deposits                  | Bank credit to deposits        | Life insurance                 | Non-life insurance              |
|------------------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|---------------------------------|
| Lagged financial inclusion index (L.FII) | 0.969 <sup>a</sup><br>(0.015)  | 0.988 <sup>a</sup><br>(0.004)  | 0.958 <sup>a</sup><br>(0.027)  | 1.146 <sup>a</sup><br>(0.043)  | 0.910 <sup>a</sup><br>(0.034)  | 0.804 <sup>a</sup><br>(0.062)   |
| Cultural and socioeconomic factors       |                                |                                |                                |                                |                                |                                 |
| Literacy rate                            | −4.113 <sup>a</sup><br>(0.463) | −1.948 <sup>a</sup><br>(0.112) | 7.539 <sup>a</sup><br>(1.610)  | −2.208 <sup>b</sup><br>(0.663) | −2.303 <sup>b</sup><br>(0.894) | −11.103 <sup>a</sup><br>(3.122) |
| Remittance                               | −0.003<br>(0.017)              | −0.006<br>(0.011)              | −0.132 <sup>a</sup><br>(0.029) | 0.115 <sup>b</sup><br>(0.034)  | 0.048 <sup>c</sup><br>(0.022)  | −0.094<br>(0.059)               |
| Policy factors                           |                                |                                |                                |                                |                                |                                 |
| Trade openness                           | 0.000 <sup>b</sup><br>(0.000)  | 0.000 <sup>c</sup><br>(0.000)  | 0.001<br>(0.001)               | −0.001 <sup>b</sup><br>(0.000) | 0.000<br>(0.001)               | 0.003 <sup>a</sup><br>(0.001)   |
| Government expenditure (GE)              | 0.005<br>(0.003)               | 0.007 <sup>a</sup><br>(0.001)  | −0.032 <sup>a</sup><br>(0.008) | −0.005<br>(0.008)              | 0.021 <sup>a</sup><br>(0.006)  | 0.021 <sup>b</sup><br>(0.007)   |
| Institutional factors                    |                                |                                |                                |                                |                                |                                 |
| Political governance                     | −0.106 <sup>b</sup><br>(0.031) | −0.010<br>(0.018)              | −0.039<br>(0.035)              | 0.086<br>(0.049)               | −0.025<br>(0.045)              | −0.238 <sup>a</sup><br>(0.059)  |
| Tax governance                           | −0.006 <sup>a</sup><br>(0.001) | −0.001<br>(0.001)              | −0.002<br>(0.002)              | −0.007 <sup>b</sup><br>(0.002) | −0.004 <sup>c</sup><br>(0.002) | −0.018 <sup>a</sup><br>(0.004)  |
| Effective trade protocol                 | 0.004 <sup>a</sup><br>(0.001)  | 0.001 <sup>a</sup><br>(0.001)  | −0.009 <sup>a</sup><br>(0.002) | −0.001<br>(0.004)              | −0.003<br>(0.003)              | −0.018 <sup>c</sup><br>(0.007)  |
| Macroeconomic factors                    |                                |                                |                                |                                |                                |                                 |
| Income                                   | 0.000<br>(0.001)               | 0.001<br>(0.001)               | 0.025 <sup>a</sup><br>(0.004)  | 0.000<br>(0.003)               | −0.011 <sup>b</sup><br>(0.004) | 0.000<br>(0.006)                |
| Inflation                                | 0.001<br>(0.005)               | −0.007 <sup>a</sup><br>(0.002) | −0.020 <sup>b</sup><br>(0.007) | 0.011<br>(0.009)               | −0.018 <sup>b</sup><br>(0.006) | −0.019 <sup>c</sup><br>(0.009)  |
| Employment                               | −0.002<br>(0.003)              | −0.004 <sup>b</sup><br>(0.001) | −0.005<br>(0.004)              | 0.002<br>(0.003)               | 0.003<br>(0.004)               | −0.022 <sup>b</sup><br>(0.008)  |
| Industry-specific factors                |                                |                                |                                |                                |                                |                                 |
| Bank efficiency                          | −0.004 <sup>c</sup><br>(0.002) | −0.006 <sup>a</sup><br>(0.000) | −0.002<br>(0.004)              | 0.008<br>(0.005)               | 0.006 <sup>c</sup><br>(0.003)  | 0.017 <sup>a</sup><br>(0.004)   |
| Gross capital formation (GCF)            | 0.005 <sup>a</sup><br>(0.001)  | 0.005 <sup>a</sup><br>(0.001)  | 0.001<br>(0.004)               | 0.025 <sup>a</sup><br>(0.005)  | 0.004<br>(0.002)               | −0.003<br>(0.009)               |
| Constant                                 | 4.273 <sup>a</sup><br>(0.565)  | 1.928 <sup>a</sup><br>(0.129)  | −6.227 <sup>a</sup><br>(1.742) | 1.854 <sup>b</sup><br>(0.596)  | 2.456 <sup>b</sup><br>(0.953)  | 14.757 <sup>a</sup><br>(3.335)  |
| Diagnostics                              |                                |                                |                                |                                |                                |                                 |
| Fisher                                   | 7734.50                        | 1.21e+6                        | 746.46                         | 3418.85                        | 46,275.31                      | 1167.03                         |
| Prob. (Wald)                             | 0.000                          | 0.000                          | 0.000                          | 0.000                          | 0.000                          | 0.000                           |
| AR1 (p-value)                            | 0.137                          | 0.158                          | 0.009                          | 0.000                          | 0.013                          | 0.191                           |
| AR2 (p-value)                            | 0.174                          | 0.372                          | 0.165                          | 0.202                          | 0.521                          | 0.524                           |
| Hansen-J OIR (p-value)                   | 0.429                          | 0.849                          | 0.855                          | 0.523                          | 0.695                          | 0.377                           |
| Sargan OIR (p-value)                     | 0.101                          | 0.123                          | 0.817                          | 0.128                          | 0.417                          | 0.598                           |
| DHT for instrument                       |                                |                                |                                |                                |                                |                                 |
| Instruments in levels                    |                                |                                |                                |                                |                                |                                 |
| H Excluding group                        | 0.110                          | 0.937                          | 0.465                          | 0.438                          | 0.860                          | 0.923                           |
| Dif (null, H = exogenous)                | 0.679                          | 0.649                          | 0.871                          | 0.518                          | 0.492                          | 0.170                           |
| IV (years, eq (diff))                    |                                |                                |                                |                                |                                |                                 |
| H excluding group                        | 0.449                          | 0.813                          | 0.866                          | 0.464                          | 0.640                          | 0.333                           |
| Dif (null, H = exogenous)                | 0.248                          | 0.789                          | 0.303                          | 1.000                          | 0.949                          | 0.661                           |
| Observations                             | 534                            | 538                            | 600                            | 600                            | 635                            | 635                             |

Notes: Statistical significance.

<sup>a</sup> 0.1%.

<sup>b</sup> 1%, and.

<sup>c</sup> 5%. Standard errors are in parentheses.

increase the likelihood of having a bank account but have no effect on credit use.

**6.1.1.2. Policy factors.** Our analysis of some policy factors shows that trade openness contributes to usage and quality. However, government expenditure tends to decrease financial access and quality but has a positive impact on usage. The negative impact on access and quality could be related to crowding-out effects, as discussed by Caballero and Krishnamurthy (2004).

**6.1.1.3. Institutional factors.** We show that political governance makes a significant contribution to enhancing financial inclusion across all dimensions. Further, we find that tax governance impacts financial access and usage. Effective trade protocols have a decreasing impact on financial usage and quality.

**6.1.1.4. Macroeconomic factors.** Income levels improve financial usage

and quality, which aligns with the findings by Honohan (2008), and income reduces financial access in SSA. A high inflation rate reduces financial usage by diminishing the real value of money and incentives for saving. The employment rate or having a job improves the quality of financial services and products.

**6.1.1.5. Industry-specific factors.** Greater bank efficiency positively impacts access to financial services, reflecting the role of well-functioning banks in expanding reach, reducing transaction costs, and providing higher-quality financial services. GCF appears to have a mixed result across dimensions. It promotes financial accessibility, and its impact on access could be related to increased investment in financial infrastructure. Improved infrastructure lowers the cost of banking services and makes expanding bank locations more economically viable (Beck et al., 2007). It enhances people's ability to access and use banking services. However, GCF reduces financial usage and quality.

### 6.1.2. Determinants of financial inclusion dimensions in the OECD countries

**6.1.2.1. Cultural and socioeconomic factors.** The effect of the literacy rate in the robustness tests appears to be consistent with that of the baseline results. The literacy rate is associated with a decreasing impact on financial usage and quality. The results also show that remittances make a positive contribution to financial accessibility and usage but have a negative impact on quality. Remittance senders and recipients in the OECD engage with banks or other financial institutions to receive or send funds, which can lead to further engagement with financial products.

**6.1.2.2. Policy factors.** Our analysis shows that trade openness contributes to increased financial access and quality. Likewise, government expenditure positively impacts financial access and quality. These results might be obtained because government expenditure on social programs and other investment encourages financial inclusion by improving the accessibility and quality of financial services and products (Conroy et al., 2009).

**6.1.2.3. Institutional factors.** Political governance is positively associated with increased access to financial services and products. The political environment enhances financial expansion by providing a secure and predictable environment for financial operations. Further, tax governance reduces usage of financial services. This impact could be related to the effect of taxation on disposable income and financial behavior (Pavlova, 2016). Effective trade protocols also have a decreasing impact on financial access and quality but contribute to increased financial usage.

**6.1.2.4. Macroeconomic factors.** Regarding the impact of income levels, we observe that income is negatively associated with the access and quality dimensions. Also, inflation makes a positive contribution to improved access and usage of financial services and products. However, higher inflation degrades the quality of financial services. We also find that higher employment levels might be associated with lower quality in financial services, whether perceived or in reality, perhaps because increased demand puts pressure on service delivery.

**6.1.2.5. Industry-specific factors.** Bank efficiency positively impacts the quality of financial services but reduces access to them. This mixed effect might reflect the trade-offs between efficiency and accessibility in developed financial systems. We also find that GCF has mixed results across dimensions; it positively influences financial usage but decreases the access and quality dimensions.

### 6.2. Robustness test 2: Alternative measure of financial inclusion using a single indicator

Finally, we re-estimate the regression using the various financial inclusion indicators as a single measure of the dependent variable. We present the results for SSA in Table 5. Cultural and socioeconomic factors have mixed effects, in which the literacy rate is linked to a decreasing effect on ATMs and bank credit. At the same time, remittances have a positive impact on bank deposits but reduce the number of bank branches. Our results show that, among policy factors, trade openness reduces the number of ATMs. Government expenditure also reduces the number of bank branches and sales of non-life insurance. Institutional factors such as political governance positively affect bank deposits and bank credit, indicating the importance of a stable political environment. However, tax governance has mixed effects across different indicators. We also find that macroeconomic factors have various impacts, in which income contributes to increases in ATMs and bank deposits. Inflation is also linked to a reduction in bank deposits

and non-life insurance. Finally, among the industry-specific indicators, bank efficiency is associated with improvement in bank credit and increases in non-life insurance, whereas GCF positively expands the number of ATMs and bank branches.

Table 6 presents the results for OECD countries. We show that literacy rates contribute significantly to increases in bank deposits but are associated with reductions in other indicators. Remittances are linked to a diminution in bank deposits but contribute to increase in credit and life insurance. Trade openness promotes increases in ATMs, bank branches, and non-life insurance but reductions in bank credit. Surprisingly, political governance is associated with reductions in ATMs and non-life insurance. Tax governance generally contributes to decreases in financial inclusion through reductions in ATMs, bank credit, life insurance, and non-life insurance. Effective trade protocols improve all access indicators but reduce bank deposits and non-life insurance. Income levels are linked to increases in deposits but reductions in life insurance.

Further, inflation is associated with reductions in most indicators, including bank branches, deposits, non-life insurance, and life insurance. Bank efficiency is associated with reductions in ATMs and bank branches but contributes to growth in both types of insurance, possibly indicating a shift to digital services. GCF is linked to increases in ATMs, bank branches, and credit.

The results from the robustness tests are not materially different from our baseline results. They demonstrate that our baseline results are robust to an alternative variable for measuring financial inclusion, showing the consistency and reliability of our methodology.

## 7. Conclusion and policy implications

Financial inclusion has been recognized as an essential policy tool for world development because of its important role in the economy. The World Bank advocates a financial inclusion strategy, coupled with sufficient financial investment and robust policy framework. This includes exploring and pinpointing the essential factors that boost inclusion and make formal financial services accessible. To do so, we examine the determinants of financial inclusion in SSA and OECD economies and analyze their differences and similarities at the macro level. We develop a financial inclusion index that reflects the accessibility, usage, and quality of financial products and services. We used an SGMM dynamic panel data estimation to address endogeneity issues and omitted variables to examine the determinants of financial inclusion across 31 SSA countries and 38 OECD countries. Overall, we offer new perspectives about the variables that are relevant to financial inclusion, account for recent economic developments, such as the impact of COVID-19, and provide a comparative approach that highlights new opportunities for advancing and bridging the gaps in financial inclusion.

In SSA, literacy rates, trade openness, political stability, and bank efficiency positively contribute to financial inclusion. However, remittances, government expenditure, income levels, and GCF have decreasing effects. Specifically, the impact of literacy rates in SSA emphasizes the importance of practical education in promoting financial inclusion. These findings support the World Bank's position and other literature on the importance of literacy in financial inclusion (Ansar et al., 2023; Ha et al., 2023). The picture is different in OECD countries. Remittances, effective trade protocols, income levels, inflation, employment rates, bank efficiency, and GCF positively impact financial inclusion. Notably, literacy rates and the tax burden reduce financial inclusion in OECD countries. Trade openness also has an insignificant effect, likely due to homogeneity in the trade structure and regulatory environment in these countries.

Both regions are sensitive to institutional factors; in particular, political governance in SSA and effective trade protocols in OECD countries positively influence financial inclusion. These similarities point to the universal importance of strong institutions in fostering an environment that is conducive to financial inclusion.

We emphasize that educational policies that promote literacy could

improve financial inclusion levels. In OECD countries, designing inclusive services for varying levels of financial literacy is crucial. As the financial industry evolves, with a constant influx of new products and services, literate and illiterate individuals engage in the formal financial system. These new consumers might require more and better information to improve their understanding of financial services and products. One approach regarding financial literacy training could be via “learning by doing” when they open or use their accounts (Ansar et al., 2023).

Educational reforms should include initiatives that focus on financial innovation and digital literacy. The World Bank encourages financial services providers and regulators to offer information for customers in straightforward language and in a simple format. We also recommend that information on financial services and products be provided in the local languages of the various countries. This initiative could complement existing literacy policies and initiatives, such as Ghana’s National Literacy Acceleration Program, Nigeria’s National Mass Education Commission, and South Africa’s Kha Ri Gude Mass Literacy Campaign. These programs emphasize teaching and learning in native languages, as well as literacy, numeracy, and spoken English skills.

Prioritizing financial literacy can also be considered a CSR initiative through targeted interventions. When government resources are limited, financial institutions could offer financial education and literacy programs for underserved communities to promote their awareness and understanding of financial products and services. Encouraging this CSR initiative through financial institutions is a win-win proposition for all parties.

Both regions would benefit from policies that promote bank efficiency, potentially through technological innovation and regulatory reforms. Bank efficiency can be achieved through information and structural and regulatory reforms, rather than political pressure, which could make the financial market less susceptible to external shocks. Maintaining an effective banking system is vital for economic

sustainability, as it ensures the uninterrupted provision of financial products and services (Agarwala et al., 2023) and improvement in financial innovation through technology-driven solutions and new products.

## Declaration of interests

The authors declare that they have no competing interests.

## CRediT authorship contribution statement

**Samuel Fiifi Eshun:** Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **Evžen Kočenda:** Conceptualization, Resources, Writing – original draft, Writing – review & editing, Supervision, Funding acquisition, Visualization.

## Availability of data and materials

The datasets used are available from the corresponding author upon reasonable request.

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## APPENDIX

Appendix Table A1. List of the 31 countries in sub-Saharan Africa (SSA) and 38 countries in the Organization for Economic Cooperation and Development (OECD) in the sample

| SSA countries                    |                    | OECD countries    |                                  |
|----------------------------------|--------------------|-------------------|----------------------------------|
| <b>East Africa</b>               | <b>West Africa</b> | <b>Asia</b>       | Poland                           |
| Burundi                          | Benin              | Israel            | Portugal                         |
| Kenya                            | Burkina Faso       | Japan             | Slovakia                         |
| Madagascar                       | Cape Verde         | Republic of Korea | Slovenia                         |
| Mauritius                        | Côte d'Ivoire      |                   | Spain                            |
| Mozambique                       | The Gambia         | <b>Europe</b>     | Sweden                           |
| Rwanda                           | Ghana              | Austria           | Switzerland                      |
| Tanzania                         | Guinea             | Belgium           | Türkiye                          |
| Uganda                           | Mali               | Czechia           | United Kingdom                   |
|                                  | Niger              | Denmark           |                                  |
| <b>Central Africa</b>            | Nigeria            | Estonia           | <b>North and Central America</b> |
| Angola                           | Senegal            | Finland           | Canada                           |
| Cameroon                         | Sierra Leone       | France            | Costa Rica                       |
| Chad                             | Togo               | Germany           | Mexico                           |
| Democratic Republic of the Congo |                    | Greece            | United States                    |
| Gabon                            |                    | Hungary           |                                  |
| Republic of the Congo            |                    | Iceland           | <b>Oceania</b>                   |
|                                  |                    | Ireland           | Australia                        |
| <b>Southern Africa</b>           |                    | Italy             | New Zealand                      |
| Botswana                         |                    | Latvia            |                                  |
| Eswatini                         |                    | Lithuania         | <b>South America</b>             |
| Namibia                          |                    | Luxembourg        | Chile                            |
| South Africa                     |                    | Netherlands       | Colombia                         |
|                                  |                    | Norway            |                                  |

Appendix Table A2. Component variables in the Financial Inclusion Index

| Components                       | Individual indicator(s)                                         | Source                                  |
|----------------------------------|-----------------------------------------------------------------|-----------------------------------------|
| ATM per 100,000 adults           | Number of ATMs per 100,000 adults.                              | Global financial development, 2000–2021 |
| Bank branches per 100,000 adults | Number of commercial bank branches per 100,000 adults.          | Global financial development, 2000–2021 |
| Bank deposits                    | Bank deposits as a share of the gross domestic product (GDP).   | Global financial development, 2000–2021 |
| Bank credit to bank deposits     | Credit extended by domestic banks as a share of total deposits. | Global financial development, 2000–2021 |
| Life insurance premium           | Ratio of life insurance premium volume to GDP.                  | Global financial development, 2000–2021 |
| Non-life insurance premium       | Ratio of non-life insurance premium volume to GDP.              | Global financial development, 2000–2021 |

Appendix Table A3. Variable definitions

| Variable                  | Definition                                                                                                      | Source                                  |
|---------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Financial inclusion index | Principal component analysis of six variable estimates that measure access, usage, and quality of products      | See Appendix Table A2                   |
| Trade openness            | Sum of exports and imports of goods and services as a share of GDP                                              | World development indicators 2000–2021  |
| Bank efficiency           | Bank Z-score                                                                                                    | Global financial development, 2000–2021 |
| Remittances               | Personal remittances received (% of GDP)                                                                        | World development indicators 2000–2021  |
| Income                    | Gross domestic product (GDP) per capita                                                                         | World development indicators 2000–2021  |
| Literacy rate             | School enrollment, tertiary                                                                                     | World development indicators 2000–2021  |
| Inflation                 | Consumer price index                                                                                            | World development indicators 2000–2021  |
| Government expenditure    | Annual percentage growth of general government final consumption expenditure                                    | World development indicators 2000–2021  |
| Employment rate           | Employment, total (% of total labor force)                                                                      | World development indicators 2000–2021  |
| Gross capital formation   | Gross capital formation (% of GDP)                                                                              | World development indicators 2000–2021  |
| Political governance      | Political stability: Estimate of governance performance, ranging from approximately –2.5 (weak) to 2.5 (strong) | World development indicators 2000–2021  |
| Tax governance            | Tax burden: Marginal tax rates imposed by all governments as a percentage of GDP                                | World development indicators 2000–2021  |
| Effective trade protocol  | Trade freedom: Extent of tariff and nontariff barriers to trade in goods and services                           | World development indicators 2000–2021  |

Appendix Table A4. Estimation results of principal component analysis, Financial Inclusion Index of SSA

|                                        | Coefficient | Std. Error. | z      | P-value | Eigenvalue of the correlation matrix |                                         |
|----------------------------------------|-------------|-------------|--------|---------|--------------------------------------|-----------------------------------------|
| Eigenvalues                            |             |             |        |         |                                      |                                         |
| Component 1                            | 4.176       | 0.309       | 13.530 | 0.000   | Component no.                        | Cumulative percentage of total variance |
| Eigenvectors of the first component    |             |             |        |         |                                      |                                         |
| ATMs                                   | 0.440       | 0.013       | 34.050 | 0.000   | 1                                    | 0.696                                   |
| Bank branches per 100,000 adults (BBA) | 0.459       | 0.010       | 47.740 | 0.000   | 2                                    | 0.838                                   |
| Bank credit to bank deposits           | 0.262       | 0.027       | 9.840  | 0.000   | 3                                    | 0.940                                   |
| Bank deposits                          | 0.346       | 0.022       | 15.800 | 0.000   | 4                                    | 0.979                                   |
| Life insurance                         | 0.451       | 0.011       | 41.120 | 0.000   | 5                                    | 0.995                                   |
| Non-life Insurance                     | 0.451       | 0.011       | 42.010 | 0.000   | 6                                    | 1.000                                   |

Appendix Table A5. Estimation results of the principal component analysis, Financial Inclusion Index of OECD countries

|                                     | Coefficient | Std. Error. | z      | P-value | Eigenvalue of the correlation matrix |                                         |
|-------------------------------------|-------------|-------------|--------|---------|--------------------------------------|-----------------------------------------|
| Eigenvalues                         |             |             |        |         |                                      |                                         |
| Component 1                         | 2.287       | 0.134       | 17.040 | 0.000   | Component no.                        | Cumulative percentage of total variance |
| Eigenvectors of the first component |             |             |        |         |                                      |                                         |
| ATMs                                | 0.575       | 0.029       | 19.730 | 0.000   | 1                                    | 0.381                                   |
| BBA                                 | 0.535       | 0.038       | 13.910 | 0.000   | 2                                    | 0.641                                   |
| Bank credit to bank deposits        | 0.157       | 0.068       | 2.330  | 0.020   | 3                                    | 0.824                                   |
| Bank deposits                       | 0.188       | 0.073       | 2.580  | 0.010   | 4                                    | 0.912                                   |
| Life insurance                      | 0.438       | 0.040       | 11.000 | 0.000   | 5                                    | 0.987                                   |
| Non-life Insurance                  | 0.363       | 0.049       | 7.420  | 0.000   | 6                                    | 1.000                                   |

Appendix Table A6. Descriptive Statistics, SSA

| Variable                        | Observations | Mean    | Std. Dev. | Minimum | Maximum  |
|---------------------------------|--------------|---------|-----------|---------|----------|
| Financial inclusion index (FII) | 366          | 0       | 1.00      | −1.339  | 3.902    |
| Trade openness                  | 680          | 67.13   | 28.468    | 16.352  | 175.798  |
| Banks' efficiency               | 565          | 14.476  | 5.444     | 2.731   | 32.07    |
| Remittances                     | 639          | 2.581   | 3.387     | 0       | 26.837   |
| Literacy                        | 451          | 8.98    | 8.06      | 0.64    | 43.96    |
| Income                          | 682          | 1920.16 | 2248.06   | 114.37  | 11645.98 |
| Inflation                       | 652          | 8.398   | 28.974    | −8.975  | 513.907  |
| Gross capital formation (GCF)   | 673          | 22.775  | 9.215     | 1.097   | 79.401   |
| Government expenditure (GE)     | 633          | 7.228   | 28.446    | −55.348 | 565.539  |
| Employment rate                 | 682          | 62.03   | 13.58     | 35.13   | 86.03    |
| Political governance            | 651          | −0.484  | 0.873     | −2.523  | 1.224    |
| Tax governance                  | 662          | 72.234  | 10.142    | 44.8    | 92.5     |
| Effective trade protocol        | 662          | 64.847  | 11.578    | 0       | 89       |

Appendix Table A7. Descriptive Statistics, OECD Countries

| Variable                        | Observations | Mean     | Std. Dev. | Minimum | Maximum |
|---------------------------------|--------------|----------|-----------|---------|---------|
| Financial inclusion index (FII) | 575          | 0        | 1.00      | −1.87   | 4.19    |
| Trade openness                  | 836          | 93.45    | 54.91     | 19.56   | 388.12  |
| Bank efficiency                 | 803          | 15.80    | 9.71      | −0.33   | 57.441  |
| Remittances                     | 835          | 0.89     | 1.03      | 0       | 6.01    |
| Literacy                        | 704          | 67.31    | 20.37     | 9.85    | 150.20  |
| Income                          | 836          | 33755.11 | 23059.84  | 2305.08 | 134000  |
| Inflation                       | 836          | 2.792    | 3.92      | −4.48   | 54.91   |
| GCF                             | 836          | 23.43    | 4.42      | 11.89   | 54.96   |
| GE                              | 836          | 2.24     | 2.51      | −10.06  | 12.63   |
| Employment rate                 | 836          | 55.973   | 6.38      | 37.737  | 76.85   |
| Political governance            | 798          | 0.643    | 0.717     | −2.376  | 1.759   |
| Tax governance                  | 836          | 64.588   | 13.2242   | 29.8    | 93.6    |
| Effective trade protocol        | 836          | 83.158   | 5.150     | 57.4    | 92.4    |

Appendix Table A8. Pairwise correlations, SSA

| Variables                | FII    | Trade  | Bank efficiency | Remittance | Literacy | Income | Inflation | GCF    | GE     | Employment | Political governance | Tax governance | Effective trade protocol |
|--------------------------|--------|--------|-----------------|------------|----------|--------|-----------|--------|--------|------------|----------------------|----------------|--------------------------|
| FII                      | 1.000  |        |                 |            |          |        |           |        |        |            |                      |                |                          |
| Trade openness           | 0.324  | 1.000  |                 |            |          |        |           |        |        |            |                      |                |                          |
| Bank efficiency          | 0.207  | 0.077  | 1.000           |            |          |        |           |        |        |            |                      |                |                          |
| Remittances              | −0.146 | 0.052  | 0.247           | 1.000      |          |        |           |        |        |            |                      |                |                          |
| Literacy rate            | 0.456  | 0.107  | 0.252           | 0.313      | 1.000    |        |           |        |        |            |                      |                |                          |
| Income                   | 0.011  | 0.140  | −0.050          | 0.028      | 0.009    | 1.000  |           |        |        |            |                      |                |                          |
| Inflation                | −0.067 | 0.007  | 0.029           | −0.160     | 0.033    | −0.008 | 1.000     |        |        |            |                      |                |                          |
| GCF                      | 0.027  | 0.468  | −0.220          | 0.234      | −0.024   | 0.092  | −0.084    | 1.000  |        |            |                      |                |                          |
| GE                       | −0.101 | −0.004 | 0.028           | 0.015      | −0.104   | −0.051 | 0.087     | −0.013 | 1.000  |            |                      |                |                          |
| Employment               | −0.576 | −0.284 | −0.435          | −0.217     | −0.281   | −0.034 | 0.154     | 0.165  | 0.010  | 1.000      |                      |                |                          |
| Political governance     | 0.503  | 0.584  | 0.067           | 0.047      | 0.453    | 0.061  | −0.056    | 0.196  | −0.108 | −0.327     | 1.000                |                |                          |
| Tax governance           | −0.036 | 0.184  | 0.054           | 0.024      | 0.340    | −0.050 | 0.250     | −0.022 | 0.059  | 0.152      | 0.196                | 1.000          |                          |
| Effective trade protocol | 0.351  | 0.248  | 0.158           | −0.078     | 0.416    | −0.063 | 0.002     | −0.006 | −0.064 | −0.159     | 0.278                | 0.319          | 1.000                    |

Appendix Table A9. Pairwise correlations, OECD Economies

| Variables                | FII    | Trade  | Bank efficiency | Remittance | Literacy | Income | Inflation | GCF    | GE     | Employment | Political governance | Tax governance | Effective trade protocol |
|--------------------------|--------|--------|-----------------|------------|----------|--------|-----------|--------|--------|------------|----------------------|----------------|--------------------------|
| FII                      | 1.000  |        |                 |            |          |        |           |        |        |            |                      |                |                          |
| Trade openness           | −0.355 | 1.000  |                 |            |          |        |           |        |        |            |                      |                |                          |
| Bank efficiency          | −0.148 | 0.278  | 1.000           |            |          |        |           |        |        |            |                      |                |                          |
| Remittances              | −0.189 | 0.475  | −0.069          | 1.000      |          |        |           |        |        |            |                      |                |                          |
| Literacy rate            | 0.014  | 0.172  | 0.254           | 0.124      | 1.000    |        |           |        |        |            |                      |                |                          |
| Income                   | −0.114 | 0.066  | −0.064          | 0.204      | −0.042   | 1.000  |           |        |        |            |                      |                |                          |
| Inflation                | 0.134  | −0.120 | −0.183          | 0.125      | −0.108   | −0.062 | 1.000     |        |        |            |                      |                |                          |
| GCF                      | 0.049  | 0.036  | −0.076          | −0.029     | 0.054    | 0.100  | 0.277     | 1.000  |        |            |                      |                |                          |
| GE                       | −0.039 | −0.008 | 0.077           | −0.030     | −0.027   | 0.227  | 0.204     | 0.443  | 1.000  |            |                      |                |                          |
| Employment               | 0.160  | 0.119  | 0.318           | −0.246     | 0.157    | −0.051 | −0.214    | 0.180  | 0.026  | 1.000      |                      |                |                          |
| Political governance     | 0.069  | 0.394  | 0.086           | −0.006     | 0.068    | −0.031 | −0.298    | −0.005 | −0.182 | 0.355      | 1.000                |                |                          |
| Tax governance           | −0.252 | 0.118  | −0.220          | 0.429      | −0.153   | 0.297  | 0.310     | 0.182  | 0.163  | −0.068     | −0.165               | 1.000          |                          |
| Effective trade protocol | 0.031  | 0.252  | 0.069           | 0.032      | −0.008   | −0.050 | −0.254    | −0.164 | −0.219 | 0.029      | 0.328                | −0.060         | 1.000                    |

Appendix Table A10. Unit-root test of the SSA variables at levels

| Variable               | Reverse chi-squared | Reverse normal     | Reverse logit      | Modified rev. chi-squared |
|------------------------|---------------------|--------------------|--------------------|---------------------------|
| Financial inclusion    | 144.251<br>(0.000)  | −3.772<br>(0.000)  | −4.750<br>(0.000)  | 7.691<br>(0.000)          |
| Trade openness         | 93.151<br>(0.006)   | −2.181<br>(0.015)  | −2.413<br>(0.009)  | 2.797<br>(0.003)          |
| Bank efficiency        | 230.749<br>(0.000)  | −7.171<br>(0.000)  | −9.797<br>(0.000)  | 15.587<br>(0.000)         |
| Remittances            | 121.577<br>(0.000)  | −2.837<br>(0.002)  | −3.294<br>(0.000)  | 5.350<br>(0.000)          |
| Income                 | 368.859<br>(0.000)  | −13.663<br>(0.000) | −18.042<br>(0.000) | 27.557<br>(0.000)         |
| Literacy rate          | 156.959<br>(0.000)  | −7.573<br>(0.000)  | −7.867<br>(0.000)  | 9.907<br>(0.000)          |
| Inflation              | 323.601<br>(0.000)  | −11.231<br>(0.000) | −15.229<br>(0.000) | 23.492<br>(0.000)         |
| GE                     | 110.766<br>(0.000)  | −3.361<br>(0.000)  | −3.776<br>(0.000)  | 4.379<br>(0.000)          |
| Employment rate        | 189.451<br>(0.000)  | −9.144<br>(0.000)  | −9.201<br>(0.000)  | 11.445<br>(0.000)         |
| GCF                    | 174.887<br>(0.000)  | −7.855<br>(0.000)  | −8.141<br>(0.000)  | 10.138<br>(0.000)         |
| Political governance   | 114.426<br>(0.000)  | −2.629<br>(0.004)  | −3.040<br>(0.001)  | 4.708<br>(0.000)          |
| Tax governance         | 115.835<br>(0.000)  | −4.643<br>(0.000)  | −4.673<br>(0.000)  | 4.835<br>(0.000)          |
| Effective tax protocol | 183.726<br>(0.000)  | −6.691<br>(0.000)  | −8.190<br>(0.000)  | 10.931<br>(0.000)         |

Notes: P-values in parentheses. The descriptions of tests are p, Z, L\*, and Pm values, which represents reverse chi-squared, reverse normal, reverse logit, and modified rev. chi-squared, respectively.

Appendix Table A11. Unit-root test of the OECD variables at levels

| Variable                 | Reverse chi-squared | Reverse normal     | Reverse logit      | Modified rev. Chi-squared |
|--------------------------|---------------------|--------------------|--------------------|---------------------------|
| Financial inclusion      | 129.749<br>(0.000)  | −3.917<br>(0.000)  | −3.954<br>(0.000)  | 4.812<br>(0.000)          |
| Trade openness           | 136.384<br>(0.006)  | −3.930<br>(0.015)  | −4.062<br>(0.009)  | 4.898<br>(0.003)          |
| Bank efficiency          | 149.502<br>(0.000)  | −2.894<br>(0.002)  | −4.257<br>(0.000)  | 5.962<br>(0.000)          |
| Remittances              | 185.973<br>(0.000)  | −1.788<br>(0.037)  | −4.453<br>(0.000)  | 8.920<br>(0.000)          |
| Income                   | 111.674<br>(0.005)  | −2.774<br>(0.003)  | −2.858<br>(0.002)  | 2.894<br>(0.002)          |
| Literacy rate            | 111.926<br>(0.005)  | −3.058<br>(0.001)  | −3.720<br>(0.000)  | 2.914<br>(0.002)          |
| Inflation                | 106.706<br>(0.012)  | −1.585<br>(0.057)  | −2.005<br>(0.023)  | 2.491<br>(0.006)          |
| GE                       | 114.789<br>(0.003)  | −2.620<br>(0.004)  | −2.616<br>(0.005)  | 3.146<br>(0.000)          |
| Employment rate          | 243.206<br>(0.000)  | −10.206<br>(0.000) | −10.636<br>(0.000) | 13.562<br>(0.000)         |
| GCF                      | 101.547<br>(0.027)  | −1.896<br>(0.029)  | −1.805<br>(0.036)  | 2.072<br>(0.019)          |
| Political governance     | 150.996<br>(0.000)  | −4.530<br>(0.000)  | −5.026<br>(0.000)  | 6.083<br>(0.000)          |
| Tax governance           | 260.101<br>(0.000)  | −7.903<br>(0.000)  | −10.531<br>(0.000) | 14.933<br>(0.000)         |
| Effective trade protocol | 113.711<br>(0.003)  | −3.773<br>(0.000)  | −3.650<br>(0.000)  | 3.059<br>(0.001)          |

Notes: P-values in parentheses. The descriptions of tests are p, Z, L\*, and Pm values, which represents reverse chi-squared, reverse normal, reverse logit, and modified rev. chi-squared, respectively.

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