

The role of financial inclusion in achieving finance-related sustainable development goals (SDGs): a cross-country analysis

Shen Yap, Hui Shan Lee & Ping Xin Liew

To cite this article: Shen Yap, Hui Shan Lee & Ping Xin Liew (2023) The role of financial inclusion in achieving finance-related sustainable development goals (SDGs): a cross-country analysis, Economic Research-Ekonomiska Istraživanja, 36:3, 2212028, DOI: [10.1080/1331677X.2023.2212028](https://doi.org/10.1080/1331677X.2023.2212028)

To link to this article: <https://doi.org/10.1080/1331677X.2023.2212028>



© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 02 Jun 2023.



Submit your article to this journal [↗](#)



Article views: 455




View related articles [↗](#)



View Crossmark data [↗](#)

The role of financial inclusion in achieving finance-related sustainable development goals (SDGs): a cross-country analysis

Shen Yap , Hui Shan Lee  and Ping Xin Liew 

Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Selangor, Malaysia

ABSTRACT

Financial inclusion is critical for the achievement of the Sustainable Development Goals (SDGs). Therefore, as there is a lack of extant studies linking financial inclusion to the SDGs, this present study used a panel regression model to examine the individual and combined effects of financial inclusion on the SDGs in selected countries between 2017 to 2020. As most extant studies have only examined specific SDGs individually, this present study is the first to examine the correlation between financial inclusion and finance-related Sustainable Development Goals (SDGs). The findings indicate that financial inclusion positively correlates to the 2nd, 5th, and 8th SDGs but not significantly enough to the 1st, 3rd, 9th, and 10th SDGs. A significant and positive correlation was also identified between financial inclusion and sustainable development in its entirety (finance-related SDG index). As financial inclusion may not directly affect all the SDGs, the uniqueness of this present study is that it examines seven finance-related aspects of SDGs, as outlined by the World Bank. The findings could encourage policymakers to increase efforts to raise the extent of financial inclusion to enhance the finance-related SDGs.

ARTICLE HISTORY

Received 21 December 2022
Accepted 22 April 2023

KEYWORDS

Financial inclusion; sustainable development goals; financial inclusion index; SDG index; World Bank

SUBJECT

CLASSIFICATION CODES
B26; G10; I30

1. Introduction

Globally, many improvements can be observed in financial systems alongside technological advancements and greater innovation. However, despite these developments, as many as 1.7 billion people are still excluded from formal financial systems (World Bank, 2017). This may be attributed to their participation in the informal sector (Achugamonu et al., 2020), which prevents them from accessing affordable and adequate financial services. Financial exclusion may hinder sustainable development by limiting access to financial resources and preventing excluded communities from fully engaging in economic activities, thereby perpetuating poverty and inequality as well as severely impacting their social and environmental well-being. Furthermore, the challenges in achieving

CONTACT Hui Shan Lee  hslee@utar.edu.my

© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

financial inclusion, such as high levels of poverty and inequality, can make it harder for individuals and communities to save, invest, and build financial resilience, thus making it more difficult to meet the Sustainable Development Goals (SDGs) (World Bank, 2022). As financial systems around the globe remain far from inclusive, addressing financial inclusion to realise the SDGs has increased in prominence.

International organisations, such as the World Bank and the United Nations (UN), play an important role in pushing the financial inclusion agenda. For the World Bank, one of the core pillars of its sustainable development agenda is to ensure universal financial access. Therefore, financial inclusion and sustainable development have become two development objectives with far-reaching beneficial consequences for society and the environment. As a result, the two agendas have recently received a lot of attention in the international development community. Recent studies on financial inclusion and sustainable development indicate that the two notions have been examined as separate and mutually exclusive views, without the possibility of a connection between the two (Ozili, 2022). Meanwhile, in the 2030 Sustainable Development Agenda of the UN, financial inclusion and the resultant expansion of financial facilities are prominently positioned as a veritable tool towards achieving seven of the 17 SDGs. These seven SDGs are, more specifically, eradicating poverty (SDG1), ending hunger and promoting sustainable agriculture (SDG2), promoting health and well-being (SDG3), achieving gender equality and the economic empowerment of women (SDG5), promoting economic growth and jobs (SDG8), supporting industry, innovation, and infrastructure (SDG9), and reducing inequality (SDG10). As such, this present study was motivated to examine the correlation between financial inclusion and the finance-related SDGs.

The focus of SDGs ranges from the environment, to society, and the economy. The SDG index, a synthetic measure that encapsulates every aspect of sustainable development, is the most commonly used measurement tool. Extant studies have only used indicators that solely capture certain aspects of sustainable development, such as poverty (Burgess & Pande, 2005; Inoue & Hamori, 2012), inequality (De Haan & Sturm, 2017), and growth (Levine, 2005). However, both these measurements had drawbacks and were deemed unsuitable for this present study as the former was too broad and the latter was too narrow. To date, no study has examined every finance-related aspect of the SDGs to provide a comprehensive overview of the correlation and effect of financial inclusion on sustainable development. Therefore, this present study constructed a novel finance-related SDG index; an index with a better fit as it covers the seven goals that previous studies have identified as being potentially driven by financial inclusion.

Does financial inclusion contribute to sustainable development? What happens to the correlation between financial inclusion and sustainable development when the seven finance-related SDGs are combined? With these research questions in mind, this present study examined the impact of financial inclusion on sustainable development by incorporating the seven finance-related aspects of SDGs, as outlined by the World Bank.

The contribution of this present study is threefold. Firstly, the finance-related SDG index provides a new lens for policymakers, regulators, and academics of a country to compare their finance-related sustainability to that of their regional peers with

similar economic and social fundamentals. This could potentially help them identify methods of improving the financial systems of their country, thereby promoting greater sustainable development. Secondly, the findings of this present study help pinpoint the influence of financial inclusion on specific SDGs; namely, ending hunger (SDG2), reducing gender inequality (SDG5), and promoting economic growth (SDG8). This will enable stakeholders that are interested in improving these specific goals to formulate policies targeted at the financial sector. It is also noteworthy that the contribution of financial inclusion is muted for other the goals; specifically, poverty reduction (SDG1), good health and well-being (SDG3), industry, innovation, and infrastructure (SDG9), and reducing inequality (SDG10). Lastly, by using the finance-related SDG index which combines the 1st, 2nd, 3rd, 5th, 8th, 9th, and 10th SDGs, the findings of this present study revealed that financial inclusion positively correlates to sustainable development in the studied countries. Therefore, financial reforms that are geared toward making financial service providers more inclusive could help countries achieve their finance-related SDGs.

The structure of this paper is as follows: The section that follows will review the literature on financial inclusion measurement and the relationship between financial inclusion and sustainable development. [Section 3](#) discusses the data, variables, and methodology used in the study. [Section 4](#) describes the findings and implications of the study. The final section concludes the paper.

2. Literature review

Ever since the SDG framework was implemented at the beginning of 2016, multiple models, policies, and guidelines have been developed to bridge the gaps in sustainable development (Allen et al., 2018; Yikun et al., 2023). Extant studies on sustainability highly emphasise the role of financial inclusion. The use of different channels to implement appropriate financial inclusion policies into the existing economic and social structures of a country may facilitate sustainable development. The correlation between financial inclusion and sustainable development is exemplified by the economic and social benefits that financial inclusion imparts on individuals, firms, and a government in pursuit of sustainability; such as improving earning potential, enhancing the empowerment of women by encouraging women entrepreneurs, reducing the costs of transactions, fostering good health, the faster accumulation of funds, and increased use of digital technologies. These results can be segregated into different dimensions of the SDGs to provide a clear picture of the correlation between financial inclusion and sustainable development. The following sub-sections present the hypotheses of relevant articles that have examined the correlation between financial inclusion and specific aspects of the SDGs; specifically, the 1st, 2nd, 3rd, 5th, 8th, 9th, and 10th SDGs.

2.1. Financial inclusion and poverty reduction (SDG1)

Financial inclusion is a path to long-term poverty reduction through socio-economic growth (Niaz, 2022). Multiple finance-based studies have used macro-level data at the state level to examine the correlation between financial inclusion and poverty reduction

(Burgess & Pande, 2005; Inoue & Hamori, 2012). Burgess and Pande (2005) used state-level panel data of a rural bank to examine the effect of financial inclusion on poverty reduction. The study found that the expansion of rural bank branches in India, with the support of the state government, was conducive to poverty reduction. Another study of Indian states by Inoue and Hamori (2012) examined the effect of financial inclusion on poverty. By examining the credit and deposit amounts loaned out and received by regional commercial banks, the study concluded that financial inclusion is a method of reducing poverty.

Other studies on the correlation between finance and poverty have used cross-country data to address this global issue (Honohan, 2008; Tran & Le, 2021; Park & Mercado, 2015). Honohan (2008) examined the effects of certain financial indicators on poverty reduction across 162 countries. The results indicated that financial access negatively correlates with poverty. Tran and Le (2021) reported similarly findings in developed European countries while Park and Mercado (2015) reported the same for developing Asian countries. Individuals with access to financial services have greater security and privacy regarding their money. Therefore, the first hypothesis of this present study was:

H1: Financial inclusion significantly affects poverty reduction.

2.2. Financial inclusion and ending hunger (SGD2)

According to Antle and Diagana (2003), sustainable agricultural development is a key element in combating hunger and environmental deterioration. An inclusive financial system has recently been recognised as a mechanism that incentivises sustainable agricultural practices by reshaping the agricultural system into models with high specialisation, concentration, and economies of scale. Cai et al. (2021) found that increasing credit positively converts smallholder farming systems into larger-scaled agricultural productions in China. Peng and Xu (2019) similarly found that financial inclusion and agricultural industrialisation mutually support each other, thereby suggesting that an inclusive financial system may aid the industrialisation of agricultural production. Ensuring that smallholding farmers have access to the financial resources that they require to modernise their agricultural production enables them adopt innovative technologies in their line of work (Miller & Jones, 2010). As such, higher financial access may result in investments that facilitate better yields. Therefore, the second hypothesis of this present study was:

H2: Financial inclusion may significantly affect efforts to end hunger.

2.3. Financial inclusion, health, and well-being (SGD 3)

A part of human development, well-being is understood as a multifaceted phenomenon that can be assessed by a range of measurements based on subjective and objective criteria (Forgeard et al., 2011). According to Demirgüç-Kunt et al. (2017), there may be a positive correlation between financial inclusion, economic growth, and human development. Klapper et al. (2016) suggests that financial inclusion improves health by helping

individuals overcome a health crisis while managing their medical expenses and not exhausting their savings. According to Zhuang et al. (2009), savings enable households to enhance their resilience to external shocks, smooth their consumption, build wealth, and invest in human capital development; such as schooling and medical care. A savings account enables parents to pay for their children's admission to a clinic. Out-of-pocket health care cost is one of the main reasons why many individuals remain stuck in poverty. As most studies have established the importance of financial inclusion in fostering health and well-being, the third hypothesis of this present study was:

H3: Financial inclusion significantly correlates to good health and well-being.

2.4. Financial inclusion and gender equality (SGD 5)

Staveren (2001) posits that financially-based gender biases are the cause of gender inequality and further heighten poverty among women. In their study on sub-Saharan Africa, Ohiomu and Ogbeide-Osaretin (2019) concluded that financial inclusion substantially decreases gender inequality. Access to finance empowers women as it provides them with decision-making power, boosts their self-esteem, and improves their overall socioeconomic status (Cheston & Kuhn, 2002). However, Goetz and Gupta (1996) examined the special credit institutions in Bangladesh and contrarily reports that, although providing women with access to credit would empower them economically, financial inclusion does not significantly affect their economic empowerment as the financial resources of the household are largely controlled by their husbands. Nevertheless, providing women with greater access to financial services and resources will reshape traditional gender expectations as well as enable modern women to better integrate into modern society with more freedom. Due to these mixed findings, the fourth hypothesis of this present study was:

H4: Financial inclusion significantly decreases gender inequality.

2.5. Financial inclusion and economic growth (SGD 8)

The changing financial landscape has renewed interest in the existing correlation between finance inclusion and economic growth. Levine (2005) identified the key features of a well-developed financial system as risk management, savings mobilisation, reduction of transactions and information costs, and specialisation of production. The financial sector provides borrowers with diverse low-risk and high-return financial tools to boost economic growth. The financial inclusion index that Van et al. (2021) examined found that financial inclusion positively affects economic growth in 152 countries. However, Khan et al. (2021) reported a negative correlation between financial inclusion and economic growth. Although banking institutions have attempted to reach the poor by lowering their loan standards with shorter-termed loans, whether financial inclusion contributes to economic growth depends on the types of financial services offered and what they decide to do with the money. Therefore, to meet the scholarly arguments raised in previous studies, the fifth hypothesis of this present study was:

H5: Financial inclusion significantly contributes to economic growth.

2.6. Financial inclusion and industry, innovation, and infrastructure (SGD 9)

Financial inclusion positively affects innovation as better access to financial services enables firms with financial limitations to access the financial resources that are necessary to support technological, organisational, and business innovations (Shi et al., 2019). Financial inclusion innovates the financial system by decreasing the risk and transaction costs as well as providing an efficient payment system and institutional efficiency. Qamruzzaman and Wei (2019) used the Granger causality test to examine the asymmetric correlation between financial inclusion, innovation, development, and remittance inflows in African countries. A bidirectional causality was detected between financial inclusion and innovation, which indicates that developing the financial sector encourages innovation in the financial system and *vice-versa*. Zhang and Posso, (2017) also found that green growth and eco-innovations may shift industrial structures into more sustainable patterns while decreasing dependence on traditional energy sources and creating new business opportunities. However, Lashitew et al. (2019) states that the demand-related factors of financial inclusion have an insignificant effect on the adoption of mobile money in Kenya. The study also states that the higher adoption of mobile money innovations was driven by a supportive regulated environment rather than by latent demand for financial access alone. Therefore, the Kenyan case indicates that the primary goal of financial inclusion is unattainable without a regulatory climate that decreases market uncertainties. A proper regulatory climate and effective governance within the financial inclusion framework are significantly vital for innovation-led sustainability. Therefore, to examine whether financial inclusion supports industries, innovations, and infrastructure, the sixth hypothesis of this present study was:

H6: Financial inclusion significantly supports industry, innovation, and infrastructure.

2.7. Financial inclusion and inequality (SGD 10)

As rising inequality has become a widespread concern, the effect of finance on wealth and income distribution has become a controversial issue (Omar & Inaba, 2020). Although some studies indicate a positive correlation between financial inclusion and inequality, most have reported the opposite. De Haan and Sturm (2017) found that financial development could decrease social equality while Park and Mercado (2018) found that, depending on the geographical characteristics, the level of access to finance decreases income inequality. However, García-Herrero and Turégano (2018) empirically examined whether financial inclusion decreases inequality in income distribution when key macroeconomic factors; such as economic growth and fiscal policy; are controlled. Their results validated the Kuznets curve hypothesis, where the power of financial inclusion to decrease inequality relies on the country's level of development. Therefore, the seventh hypothesis of this present study was:

H7: Financial inclusion significantly decreases inequality.

2.8. Financial inclusion and sustainable development (finance-related SDG index)

The SDGs account for economic efficiency, social responsibility, and environmental protection. In combination, these three elements are considered the pillars of

sustainable development in an integrated framework. Multiple studies have established a significant correlation between financial inclusion and different aspects of sustainable development. Although practical inferences can be drawn from their findings, examining these aspects alone may confound our understanding of how financial inclusion correlates with the multifaceted SDGs. To date, no study depicts the correlation between financial inclusion and the seven finance-related SDGs.

This present study further contributes to the literature by using a broad set of variables at a cross-country level to examine the individual and overall effects of financial inclusion on sustainable development. Therefore, the eighth hypothesis of this present study was:

H8: Financial inclusion has a marginally significant correlation with sustainable development.

3. Methodology

3.1. Computation of financial inclusion index (FI index)

As suggested by Sarma (2008), a multidimensional FI index that incorporates three dimensions: availability, accessibility, and usage of financial services is computed using an Inverse Euclidean Distance method. The initial dimension index d_i is calculated for each dimension of financial inclusion measure. The dimension index measures a country's achievement in the specific dimension e.g., access to finance. For dimensions that include more than one indicator, all the indicators are normalised using Equation (1), and the dimension index is computed using a simple weighted average, where each indicator carries equal weights. In n -dimensional Cartesian space, the economy i will be represented by a point $d_i = (d_1, d_2, d_3, \dots, d_n)$. A dimension index that has a higher value indicates higher achievement in the respective dimension. The FI index is measured by averaging two distances between the worst and the achievement point and the inverse distance between the ideal and the achievement point.

Equation (1) will first compute a dimension index for each of these dimensions:

$$d_i = w_i \frac{A_i - m_i}{M_i - m_i} \quad (1)$$

where A_i = Actual value of dimension i , m_i = Minimum value of dimension i , M_i = Maximum value of dimension i , and w_i = weight attached to dimension i .

After the three dimensions - availability, accessibility, and usage are computed with same weights assigned to them, the multidimensional financial inclusion index (FII) for each country is computed using Equation (2).

$$FII = 1 - \sqrt{\frac{(1 - d_1)^2 + (1 - d_2)^2 + (1 - d_3)^2}{n}} \quad (2)$$

The normalisation is carried out to make the value lie between 0 and 1, and an inverse distance is used so that a higher FI index value corresponds to higher financial inclusion. The dataset is obtained from the Financial Access Survey (FAS) of the International Monetary Fund (IMF). An advantage of this method is that the FI index

Table 1. Source of data for financial inclusion Index - Availability, accessibility, and usage indicators.

| Dimension | Indicators | Source |
|---------------|---|---|
| Availability | (i) Number of deposit accounts with commercial banks per 1,000 adults | Financial Assess Survey Database from International Monetary Fund |
| | (ii) Number of loan accounts with commercial banks per 1,000 adults | |
| | (iii) Number of credit cards per 1,000 adults | |
| Accessibility | (i) Number of ATMs per 100,000 adults | |
| Usage | (i) Outstanding loans from commercial banks (% of GDP) | |
| | (ii) Outstanding deposits with commercial banks (% of GDP) | |

Source: Author's own computation.

can be computed and presented on a yearly basis to evaluate the performance of financial inclusion among countries.

The source of data is presented in Table 1.

3.2.7 Finance-related sustainable development goal (SDG) index

Sustainable development is much more complex to measure than other more straightforward concepts in economics because its focus spans from the environment and society to the economy. The most commonly used measurement is the SDG index computed using the arithmetic mean method, a synthetic measure that encapsulates every aspect of sustainable development.

The scores for SDG indices were obtained from the Sustainable Development Report (<https://www.sdgindex.org>). This report is the first global research to measure each country's progress toward meeting the Sustainable Development Goals. As the scholarly consensus on whether greater weights should be assigned to one SDG over another has not yet been achieved, this study gives fixed and same weight to every SDG, mirroring the commitment of governments to treat all SDGs equally as an integrated and non-exclusive set of goals. In other words, countries need to prioritise all goals instead of ignoring some and focusing only on one to improve their overall SDG index score. After obtaining the scores for each indicator, the arithmetic mean is calculated for the indicators of the 7 SDGs. These scores are then averaged across all 7 SDGs to obtain the overall score for the SDG index. This method presents a new approach in the literature by focusing on only 7 out of 17 SDGs, which may result in different dynamics compared to the originally computed index.

3.3. Empirical model

The present study uses panel regression models in a static framework for analysing the influence of financial inclusion on Sustainable Development Goals as follows:

$$SDG_{it} = \beta_0 + \beta_1 FII_{it} + \beta_2 X_{it} + \varepsilon_{it} \quad (4)$$

where the dependent variable, SDG_{it} represents the respective 7 SDGs and the overall SDG index that enter Equation (4) separately. The subscripts of i and t refer to country and year. FII_{it} represents the FI index and X_{it} represents a vector of other control

variables, such as INF, which indicates inflation rate; POP, which refers to population growth; INT, which represents interest rate; and TRADE, which indicates the sum of exports and imports of goods and services. The data are extracted from the World Development Indicator provided by the World Bank. ε_{it} is the error term. A total of 76 countries were selected and the study period was from 2017 to 2020.

Static panel models were selected, and the suitability of Pooled Ordinary Least Square (POLS), Random Effect Model (REM) and Fixed Effect Model (FEM) was determined using the F-poolability test (POLS vs REM), the Breusch Bagan Langragian Multiplier test (POLS vs FEM) and the Hausman test (REM vs FEM).

4. Results and discussions

4.1. Financial inclusion and seven aspects of sustainable development (SDGs 1, 2, 3, 5, 8, 9 & 10)

Table 2 presents a descriptive summary of the variables. The standard deviation for the 7 SDGs is quite dispersed around the mean. This implies that the variation in these seven variables is resilient across our sample countries, and most countries are at a similar stage of sustainable development. It also suggests that it is empirically correct to combine these SDGs into a composite index.

A pairwise correlation between the variables of interest was reported in Table 3 to identify multicollinearity problems in the regression analysis. The coefficients of the

Table 2. Descriptive summary of the variables.

| Variables | Mean | Standard deviation | Minimum | Maximum |
|-----------|--------|--------------------|---------|---------|
| INF | 3.256 | 3.412 | -2.093 | 29.506 |
| INT | 6.331 | 5.317 | 0.703 | 38.403 |
| POP | 0.868 | 0.995 | -1.718 | 3.755 |
| TRADE | 95.165 | 58.778 | 24.319 | 380.104 |
| FII | 0.203 | 0.109 | 0.001 | 0.601 |
| SDG 1 | 92.341 | 16.865 | 3.230 | 100 |
| SDG 2 | 58.118 | 10.401 | 28.019 | 83.230 |
| SDG 3 | 78.914 | 14.240 | 30.935 | 97.892 |
| SDG 5 | 83.504 | 12.807 | 36.718 | 99.867 |
| SDG 8 | 70.982 | 12.795 | 30.680 | 95.758 |
| SDG 9 | 43.814 | 22.224 | 6.405 | 91.655 |
| SDG 10 | 60.024 | 26.309 | 14.565 | 100 |

Source: Author's own computation.

Table 3. Correlations among the variables.

| | INF | INT | POP | TRADE | FII | SDG1 | SDG2 | SDG3 | SDG5 | SDG8 | SDG9 | SDG10 |
|-------|---------|---------|---------|--------|---------|--------|--------|--------|--------|--------|--------|--------|
| INF | 1.0000 | | | | | | | | | | | |
| INT | 0.1272 | 1.0000 | | | | | | | | | | |
| POP | 0.1200 | 0.1549 | 1.0000 | | | | | | | | | |
| TRADE | -0.1744 | -0.2382 | -0.3760 | 1.0000 | | | | | | | | |
| FII | -0.4740 | -0.0771 | -0.0686 | 0.1623 | 1.0000 | | | | | | | |
| SDG1 | -0.2405 | -0.1134 | -0.5177 | 0.0918 | 0.2024 | 1.0000 | | | | | | |
| SDG2 | -0.2525 | 0.0321 | -0.5258 | 0.2631 | 0.3867 | 0.4627 | 1.0000 | | | | | |
| SDG3 | -0.4216 | -0.1067 | -0.5129 | 0.2929 | 0.4453 | 0.7509 | 0.6319 | 1.0000 | | | | |
| SDG5 | -0.2748 | -0.2288 | -0.5510 | 0.2791 | 0.3806 | 0.5295 | 0.5955 | 0.6982 | 1.0000 | | | |
| SDG8 | -0.4738 | -0.2267 | -0.4042 | 0.3053 | 0.4306 | 0.3969 | 0.5979 | 0.6324 | 0.5838 | 1.0000 | | |
| SDG9 | -0.3689 | -0.2195 | -0.2788 | 0.3089 | 0.6811 | 0.3750 | 0.6221 | 0.6607 | 0.6038 | 0.6311 | 1.0000 | |
| SDG10 | 0.0037 | -0.2349 | -0.4111 | 0.2174 | -0.0812 | 0.3687 | 0.3564 | 0.3384 | 0.3053 | 0.3241 | 0.3351 | 1.0000 |

Source: Author's own computation.

Table 4. Baseline estimates of the impact of the financial inclusion index on SDGs 1, 2, 3, 5, 8, 9, and 10.

| VARIABLES | FEM (1) SDG 1 | REM (2) SDG 2 | FEM (3) SDG 3 | REM (4) SDG 5 | FEM (5) SDG 8 | FEM (6) SDG 9 | FEM (7) SDG 10 |
|--------------------|---------------------|---------------------|---------------------|---------------------|----------------------|---------------------|----------------------|
| Constant | 52.91** (20.77) | 49.55*** (3.537) | 73.78*** (4.456) | 80.38*** (4.677) | 100.40*** (23.73) | 45.21*** (8.270) | 29.97 (27.60) |
| INF | 0.20 (0.319) | -0.21 (0.136) | 0.01 (0.0686) | -0.08 (0.230) | -0.56 (0.365) | -0.10 (0.127) | -0.55 (0.562) |
| INT | 1.97* (1.070) | 0.22 (0.203) | 0.06 (0.217) | -0.32 (0.265) | -3.21*** (1.154) | -1.04** (0.402) | -0.86 (1.352) |
| POP | 9.75 (6.191) | -3.56*** (1.108) | 0.42 (1.337) | -5.78*** (1.445) | -14.62** (7.122) | -5.84** (2.482) | 24.96** (10.57) |
| TRADE | 0.18 (0.221) | 0.02 (0.0239) | 0.01 (0.0479) | 0.01 (0.0304) | -0.09 (0.255) | 0.07 (0.0890) | -0.13 (0.298) |
| FII | -0.08 (39.04) | 31.50*** (9.328) | -4.76 (8.424) | 39.12*** (12.61) | 62.23** (44.86) | -6.59 (15.63) | 72.52 (50.06) |
| Poolability F-test | 9.86*** | 13.57*** | 136.94*** | 6.67*** | 2.82*** | 58.32*** | 15.93*** |
| BP LM test | 63.31*** | 77.35*** | 108.61*** | 52.12*** | 12.86*** | 99.82*** | 67.44*** |
| Hausman test | 20.42*** | 3.13 | 57.53*** | 5.46 | 11.19** | 38.65*** | 11.10** |
| Adjusted R-squared | 0.11 | 0.06 | 0.01 | 0.02 | 0.23 | 0.19 | 0.08 |
| F-statistic | 1.86 | 1.34 | 0.15 | 1.29 | 4.46*** | 3.63*** | 1.35 |
| Wald chi2(8) | 12.46** | 34.90*** | 8.87 | 38.11*** | 48.43*** | 37.89*** | 5.48 |
| Prob > chi2 | | | | | | | |

Source: Author's own computation.

variables were less than 0.8, thus suggesting an absence of a serious multicollinearity problem (Gujarati & Porter, 2009). This was also supported by the variance inflation factor (VIF) value, which was less than 10.

Table 4 shows the main findings from the baseline analysis for SDGs 1, 2, 3, 5, 8, 9, and 10. The F-poolability test, the Breusch Bagan Langragian Multiplier test and the Hausman test supported the REM as the most suitable model compared to the POLS and FEM in Models 2 and 4, whereas FEM is the most suitable model for Models 1, 3, 5, 6, and 7. The findings are interpreted from the best model only.

As seen in Model 1, there was no significant correlation between the financial inclusion index and poverty reduction (SDG1). This finding contradicts the empirical findings of Omar and Inaba (2020) and Polloni-Silva et al. (2021), which showed that financial inclusion facilitates poverty reduction. Theoretically, financial inclusion should benefit low-income individuals as better access to bank accounts should enable them to execute financial transactions and provides them with a safe repository for their savings. However, this may not be the case in real-life as poor individuals may not require formal financial services. Furthermore, financial inclusion may even result in over-indebtedness as interest rates tend to be higher if one cannot provide collateral. Inoue (2019) reported that when the Indian private sector practiced financial inclusion, it did not significantly decrease poverty. According to Gopalan and Rajan (2018), one possible reason could be that although foreign banks increase access to finance, the financial services are less frequently used. Therefore, financial inclusion may not have significantly decreased poverty in the studied countries due to the presence of foreign banks.

As seen in Model 2, there was a significant and positive correlation between financial inclusion and ending hunger (SDG 2). This finding supports the findings of Cai et al. (2021) and Peng and Xu (2019), which showed that increasing financial access to farmers increases large-scale agricultural production and industrialisation, especially in

China, where the agriculture industry is undergoing a rapid revolution. The more financial resources are available to farmers, the more they invest in machines and products that increase their yield. At a macro level, higher yields increase overall food production and directly contribute to the economic growth of predominantly emerging countries, whose economies largely rely on agriculture.

As seen in Model 3, the coefficient did not indicate a significant correlation between financial inclusion, good health, and well-being (SDG 3). According to Bovbjerg and Hadley (2007), access to finance does not necessarily result in better health and longevity. This contradicts the findings of Sakyi-Nyarko et al. (2022) and Laha and Sen (2021), who found that financial inclusion increases health and well-being. One possible explanation for the missing correlation between financial inclusion and health-related well-being could be because other factors; such as a lack of financial literacy; were not taken into consideration. Therefore, merely possessing a bank account may not lead to better health but could be a moral hazard as individuals may be more likely to engage in risk-taking behaviours.

As seen in Model 4, there was a positive and significant correlation between financial inclusion and gender equality (SDG 5). According to Robino et al. (2018), financial inclusion may bridge the gender gap by smoothing consumption, mitigating financial risks, adequate security and protections, higher savings and investments return, and fostering entrepreneurship. Providing women with access to more financial options may contribute to growth as it encourages them to participate in entrepreneurship. Furthermore, better access and financial services usage not only enable female-led businesses to grow faster and to be more sustainable but also contributes to their autonomy, which would enable them to make better decisions that they would not have otherwise made if they lacked access to financial resources. Ohiomu and Ogbeide-Osaretin (2019) examined data from sub-Saharan Africa and found that financial inclusion substantially decreases gender inequality as it provides women with the financial tools needed to earn an income, build wealth, manage financial risks, and enhance their participation in the labour market.

Similarly, as seen in Model 5, there was a significant correlation between financial inclusion and economic growth (SDG 8). Van et al. (2021) used a three-year average multidimensional financial inclusion index and concluded that there was a positive correlation between financial inclusion and economic growth.

As seen in Model 6, the coefficient indicated that there was no correlation between financial inclusion and the industry, innovation, and infrastructure (SDG 9). Although financial inclusion is well known to foster technological innovation and industrial development, its insignificant impact could be because most of the 50 studied countries were developing or the least developed countries. As such, access to finance was minimal and innovation and development had yet to make a difference. Therefore, the effect of financial inclusion on innovation and development was negligible. Allard and Williams (2020), similarly, assert that the effects of financial inclusion on innovation depend on the development of a country. Lashitew et al. (2019) also found that the demand-related factors of financial inclusion have a marginal effect on the adoption of mobile money in Kenya. The study posited that higher adoption of mobile money innovations were primarily driven by a supportive and regulated environment rather than

delayed demand for financial access alone. Therefore, apart from delivering financial access, a conducive and regulated climate that is well good governed is important to decrease market uncertainties and encourage innovation and industrial development.

As seen in Model 7, financial inclusion did not decrease inequality (SDG 10). This contradicted the findings of De Haan and Sturm (2017) and Omar and Inaba (2020), which posited that financial inclusion is crucial for decreasing inequality. Unlike extant studies which used only a group of countries with similar characteristics or developmental stages, this present study used a mixed sample of 50 countries. Therefore, one possible explanation for this discrepancy could be that the studied countries included both developing and developed countries which, potentially, decreases the effects of financial inclusion on inequality among one another. An examination by Ouechtati (2020) of 53 developing countries, similarly, found that high bank penetration rates and providing the poor with access to credit can decrease income inequality.

According to the estimation results, the main channels; namely, ending hunger (SDG2), reducing gender inequality (SDG5), and promoting economic growth (SDG8); link financial inclusion to sustainable development. This finding was similar to that of Kuada (2019), which found that inclusive financial services directly affect some of the SDGs (e.g., SDGs 1, 2, 5, and 8) while their impact on others may not be immediately evident. The lack of correlation between financial inclusion and some of the SDGs; specifically, SDG 1, 3, 9, and 10; may be attributed to (1) evidence from the literature, (2) differences in the variables that this present study and previous studies used, and (3) mediating variables that were not taken into consideration. Furthermore, as sustainable development is not only directly underpinned by financial inclusion alone, it may exert its influence *via* other indirect channels. As sustainable development is a multifaceted concept that draws on several disciplines; such as including economics, ecology, ethics, sociology, and political science; it is not enough to look at these SDGs alone to understand the aggregated effects of financial inclusion on sustainable development. Therefore, this present study developed an SDG index that incorporates indicators from the seven finance-related SDGs that had been drawn from existing theories and empirical studies.

4.2. The seven finance-related sustainable development goals (SDG) index

The country-specific SDG index considers every indicator of the seven finance-related SDGs and aggregates them into a composite index to assess the studied countries (Table 5). The finance-related SDG index helps countries understand the ways in which finance correlates to sustainable development and formulate national policies and long-term strategies to achieve the SDGs in the relevant context.

The purpose of this present study was not to compare the 50 countries, which had different levels of development, but to develop a holistic measure that includes all the finance-related SDGs. The SDG index score indicates the position of a country, with worst (0) and the best (100). For example, Belgium's overall index score (89.5) in 2020 suggested that the country was 89.5% of the way towards achieving its best performance across the seven SDGs (Table 5).

Between 2017 to 2020, Nordic countries; namely Sweden, Norway, Denmark, Iceland, Finland, and the Netherlands; topped the SDG index. Korea was the only

Table 5. Aggregated 7 finance-related SGD index from 2017 to 2020.

| Country | 2017 | | 2018 | | 2019 | | 2020 | |
|--------------------|-----------|------|-----------|------|-----------|------|-----------|------|
| | SDG index | Rank | SDG index | Rank | SDG index | Rank | SDG index | Rank |
| Albania | 67.8 | 42 | 65.3 | 48 | 66.9 | 45 | 67.2 | 45 |
| Algeria | 55.4 | 62 | 68.0 | 40 | 71.5 | 32 | 73.5 | 33 |
| Argentina | 71.4 | 32 | 68.3 | 39 | 69.2 | 40 | 71.1 | 39 |
| Australia | 84.1 | 11 | 85.2 | 13 | 83.3 | 13 | 85.2 | 13 |
| Austria | 86.0 | 8 | 87.2 | 10 | 87.4 | 8 | 89.3 | 8 |
| Azerbaijan | 70.5 | 37 | 70.1 | 35 | 71.1 | 34 | 70.4 | 40 |
| Barbados | 68.4 | 40 | 66.3 | 44 | 64.3 | 49 | 62.2 | 61 |
| Belgium | 87.6 | 6 | 87.9 | 8 | 87.1 | 9 | 89.5 | 7 |
| Bolivia | 52.8 | 67 | 61.5 | 58 | 63.3 | 53 | 65.4 | 51 |
| Brazil | 64.0 | 47 | 65.5 | 47 | 65.2 | 47 | 67.6 | 44 |
| Bulgaria | 69.4 | 39 | 71.5 | 33 | 70.0 | 39 | 71.7 | 37 |
| Cambodia | 60.9 | 55 | 61.7 | 57 | 63.6 | 51 | 63.6 | 57 |
| Chile | 68.4 | 41 | 69.7 | 36 | 71.3 | 33 | 74.8 | 32 |
| China | 71.7 | 31 | 75.2 | 25 | 79.8 | 17 | 81.4 | 19 |
| Colombia | 58.1 | 60 | 59.4 | 62 | 61.4 | 59 | 63.0 | 58 |
| Costa Rica | 52.2 | 68 | 67.1 | 43 | 67.1 | 44 | 69.0 | 41 |
| Croatia | 76.9 | 23 | 76.5 | 22 | 76.3 | 24 | 80.0 | 23 |
| Czech Republic | 84.9 | 9 | 84.0 | 15 | 84.5 | 12 | 87.1 | 12 |
| Denmark | 89.3 | 3 | 91.4 | 2 | 90.1 | 2 | 92.0 | 1 |
| Dominican Republic | 60.1 | 58 | 59.9 | 60 | 63.0 | 55 | 64.3 | 54 |
| Ecuador | 61.9 | 52 | 61.7 | 56 | 63.4 | 52 | 66.6 | 47 |
| Egypt | 54.1 | 63 | 59.9 | 61 | 61.6 | 58 | 64.4 | 53 |
| El Salvador | 60.1 | 57 | 58.8 | 65 | 60.1 | 61 | 63.0 | 59 |
| Estonia | 80.4 | 16 | 80.6 | 17 | 80.1 | 16 | 83.8 | 16 |
| Fiji | 70.9 | 35 | 75.1 | 27 | 71.0 | 35 | 66.5 | 48 |
| Finland | 87.6 | 5 | 88.5 | 6 | 88.2 | 4 | 90.0 | 5 |
| Georgia | 63.8 | 48 | 64.6 | 51 | 63.2 | 54 | 65.5 | 50 |
| Greece | 74.6 | 25 | 71.5 | 34 | 71.7 | 31 | 75.5 | 28 |
| Guatemala | 53.1 | 66 | 51.4 | 70 | 52.3 | 65 | 53.5 | 65 |
| Guyana | 61.7 | 53 | 58.1 | 66 | 50.3 | 68 | 52.7 | 67 |
| Honduras | 51.7 | 69 | 53.0 | 67 | 51.0 | 66 | 51.9 | 69 |
| Hungary | 79.1 | 20 | 77.6 | 21 | 78.1 | 21 | 81.2 | 20 |
| Iceland | 86.1 | 7 | 90.2 | 3 | 87.8 | 6 | 88.4 | 10 |
| Indonesia | 61.7 | 54 | 59.3 | 64 | 60.7 | 60 | 62.5 | 60 |
| Ireland | 84.3 | 10 | 87.3 | 9 | 85.7 | 10 | 88.7 | 9 |
| Italy | 80.2 | 17 | 79.8 | 18 | 80.9 | 15 | 83.9 | 15 |
| Jordan | 66.7 | 44 | 64.5 | 52 | 63.8 | 50 | 66.4 | 49 |
| Kazakhstan | 74.1 | 28 | 69.3 | 37 | 70.2 | 38 | 71.3 | 38 |
| Kenya | 49.6 | 70 | 51.5 | 69 | 46.8 | 72 | 52.9 | 66 |
| Korea | 74.4 | 26 | 88.4 | 7 | 88.8 | 3 | 91.3 | 2 |
| Latvia | 76.7 | 24 | 77.8 | 20 | 78.3 | 20 | 79.6 | 24 |
| Lithuania | 78.3 | 21 | 75.7 | 24 | 73.7 | 27 | 76.9 | 26 |
| Luxembourg | 82.5 | 13 | 86.3 | 11 | 83.0 | 14 | 84.9 | 14 |
| Malawi | 32.5 | 74 | 36.8 | 74 | 37.7 | 74 | 39.0 | 74 |
| Malaysia | 70.9 | 34 | 72.8 | 31 | 70.8 | 36 | 76.1 | 27 |
| Mexico | 65.8 | 46 | 62.0 | 55 | 62.9 | 56 | 66.7 | 46 |
| Moldova | 70.6 | 36 | 73.2 | 29 | 72.0 | 30 | 72.5 | 36 |
| Mozambique | 31.7 | 75 | 34.0 | 75 | 34.8 | 75 | 34.4 | 75 |
| Namibia | 41.8 | 73 | 44.5 | 73 | 45.0 | 73 | 46.0 | 73 |
| Netherlands | 89.3 | 4 | 89.7 | 4 | 87.9 | 5 | 90.2 | 4 |
| Nicaragua | 53.3 | 65 | 59.3 | 63 | 59.6 | 62 | 57.4 | 64 |
| North Macedonia | 66.8 | 43 | 67.5 | 42 | 66.1 | 46 | 68.9 | 42 |
| Norway | 89.8 | 2 | 89.3 | 5 | 87.5 | 7 | 89.8 | 6 |
| Pakistan | 53.5 | 64 | 49.9 | 71 | 49.8 | 69 | 50.5 | 71 |
| Panama | 62.4 | 50 | 62.6 | 54 | 61.8 | 57 | 64.1 | 56 |
| Paraguay | 57.3 | 61 | 63.8 | 53 | 65.1 | 48 | 65.3 | 52 |
| Peru | 62.7 | 49 | 64.7 | 50 | 67.3 | 43 | 68.4 | 43 |
| Philippines | 60.4 | 56 | 60.3 | 59 | 59.6 | 63 | 61.0 | 62 |
| Poland | 79.6 | 19 | 75.2 | 26 | 76.6 | 23 | 80.2 | 22 |
| Portugal | 77.3 | 22 | 76.2 | 23 | 76.9 | 22 | 80.3 | 21 |

(continued)

Table 5. Continued.

| Country | 2017 | | 2018 | | 2019 | | 2020 | |
|---------------------|-----------|------|-----------|------|-----------|------|-----------|------|
| | SDG index | Rank | SDG index | Rank | SDG index | Rank | SDG index | Rank |
| Romania | 74.4 | 27 | 65.9 | 46 | 67.6 | 42 | 73.0 | 34 |
| Saudi Arabia | 62.2 | 51 | 71.9 | 32 | 50.7 | 67 | 52.3 | 68 |
| Serbia | 72.0 | 30 | 73.1 | 30 | 75.4 | 25 | 78.0 | 25 |
| Singapore | 82.1 | 14 | 85.7 | 12 | 74.6 | 26 | 75.2 | 29 |
| Slovak Republic | 80.6 | 15 | 80.7 | 16 | 79.0 | 19 | 81.8 | 18 |
| Slovenia | 83.4 | 12 | 85.1 | 14 | 85.6 | 11 | 88.1 | 11 |
| South Africa | 48.0 | 72 | 49.3 | 72 | 47.9 | 70 | 51.1 | 70 |
| Spain | 80.0 | 18 | 79.2 | 19 | 79.6 | 18 | 82.2 | 17 |
| Sweden | 91.1 | 1 | 91.5 | 1 | 90.7 | 1 | 91.0 | 3 |
| Thailand | 71.0 | 33 | 69.1 | 38 | 72.5 | 29 | 75.2 | 30 |
| Trinidad and Tobago | 59.6 | 59 | 64.8 | 49 | 59.6 | 64 | 59.7 | 63 |
| Turkey | 69.6 | 38 | 67.9 | 41 | 70.6 | 37 | 72.5 | 35 |
| Uganda | 49.5 | 71 | 52.1 | 68 | 46.8 | 71 | 48.0 | 72 |
| Ukraine | 73.8 | 29 | 73.5 | 28 | 72.8 | 28 | 75.0 | 31 |
| Uzbekistan | 66.3 | 45 | 66.0 | 45 | 68.5 | 41 | 64.1 | 55 |

Source: Author's own computation.

Asian country that significantly improved its position on the SDG index as it leap-frogged from 28th in 2015 to 2nd in 2020. This indicates that Korea is well on its way to accomplishing the 2030 Agenda of the United Nations General Assembly. It is also recognised by Oxfam and Development Finance International (DFI) as the country that has enacted the most positive policy to decrease inequality and promote better well-being. Most of the countries in the top 20 were Organisation for Economic Co-operation and Development (OECD) countries. This indicates that concerted efforts to provide their people with the basic economic needs and decrease deprivation have proven fruitful. Although Singapore is Asia's premier regional hub, it dropped significantly in the SDG index and ranked 29th in 2020 compared to 14th in 2017. Therefore, rapid development and robust economic growth may not necessarily translate to sustainability as the integrated and interlinked social and economic aspects of an economy need to be comprehensively coordinated. For example, it is possible for a country to be developed but have high-income inequality.

Developing countries, such as China, Malaysia, and Thailand, significantly improved their SDG indices. China's SDG index increased steadily over time, and its rank rose from 31st to 19th while Malaysia moved from the 34th to 27th spot and Thailand from 33rd to 30th place. China has used an innovative approach to actively adopt an important domestic policy that primarily alleviates poverty. It has also unveiled an urbanisation plan to moderate inequality. The Belt and Road Initiative (BRI) led by China has proven beneficial and resulted in substantial economic gains by providing infrastructure support and improving the social well-being of its counterparts in the region (Chatzky & McBride, 2020).

Meanwhile, low-income countries, such as Uganda, Ukraine, and Uzbekistan, had lower SDG index scores primarily due to the nature of the SDGs, which focuses mainly on mitigating extreme poverty and increasing access to basic social infrastructure. Lower-income countries generally record lower economic growth and infrastructure development. Furthermore, the poverty in these countries increases societal inequality as women tend to experience higher poverty rates than men and their rights are unprotected.

Table 6. Effects of financial inclusion on sustainable development (finance-related SDG index).

| | POLS (1) SDG index | FE (2) SDG index | RE (3) SDG index |
|--------------------|--------------------------|------------------------|------------------------|
| Constant | 63.96*** (3.071) | 68.30*** (8.783) | 63.39*** (4.107) |
| INF | -0.64** (0.248) | -0.26* (0.139) | -0.32** (0.130) |
| INT | -0.24 (0.158) | -0.97** (0.440) | -0.43* (0.235) |
| POP | -3.92*** (0.870) | -1.27 (2.697) | -3.02** (1.286) |
| TRADE | 0.01 (0.0177) | -0.01 (0.0906) | 0.01 (0.0285) |
| FII | 40.67*** (8.144) | 28.87* (16.91) | 37.72*** (10.46) |
| Poolability F-test | 23.39** | | |
| BP LM test | 87.69*** | | |
| Hausman test | 0.44 | 0.14 | 4.07 |
| Adjusted R-squared | 0.41 | 0.41 | 0.45 |
| F-statistic | 19.05*** | 19.01*** | 21.75*** |
| Wald chi2(8) | | | |
| Prob > chi2 | | | |

Note: ***, ** and * denote 1%, 5% and 10% significant level respectively.

Source: Author's own computation.

It is evident that the world is headed towards achieving the SDGs as a total of 59 countries increased their SDG index scores over the examined period while only 17 countries experienced a slight decline. Therefore, many countries have taken the initiative to adopt and implement SDGs in their developmental policies in line with their global commitments. Algeria, Bolivia, Costa Rica, Egypt, and Korea have increased their SDG index scores by more than 10 places. However, the SDG index highlights that inter-country collaboration is still required to bridge the outstanding gaps despite the high scores obtained.

4.3. Financial inclusion and sustainable development (finance-related SDG index)

Table 6 depicts the estimated results of the correlation between the SDG index, financial inclusion, and other independent variables, which were obtained using the RE model (Model 3) as the poolability F-test, the Breusch-Pagan Lagrange multiplier test and the Hausman test indicated that the REM was better suited than the pooled ordinary least squares (POLS) and the fixed effects model (FEM).

Three variables; namely, the financial inclusion index (banking indicators), inflation, and population growth; were found to significantly affect sustainable development. Financial inclusion had a positive correlation with sustainable development, as supported by Churchill and Marisetty (2020) as well as Niaz (2022). It also contributes to the economic development of impoverished individuals as well as improves their income levels and expenditure on necessities, education, and medication. Financial inclusion is also a promising tool for the promotion of social stability by bridging the income gap. Dupas and Robinson (2013), similarly, state that financial inclusion significantly affects employment, consumption, and production. However, it is noteworthy that the correlation between financial inclusion and sustainable development of these

studies cannot be directly compared with that of this present study or between themselves as they each used different measures of sustainable development. More specifically, the extant studies only measured a specific aspect of the SDGs while this present study used an aggregated measure; the SDG index. This present study is the first to use an aggregated measure of finance-related SDGs. Although the results cannot be directly compared to that of extant studies, the latter provided a reference that indicated the potential correlation between financial inclusion and the multiple aspects of sustainable development.

The negative correlation between interest rates and sustainable development was insignificant as it was only 10%. This may be because increasing interest rates increases borrowing costs, decreases disposable income, and limits consumption-driven growth. People also preferred to deposit their money in the bank than invest it in more lucrative investment opportunities. Due to lower credit, investing in production and infrastructure supports sustainable development. These results, however, contradicted the findings of Sujianto et al. (2020), who found that economic growth responds positively to real interest rate increases. Although an increase in interest rates is expected to discourage borrowers from investing, high interest rates did not deter Indonesians. Therefore, borrowers are willing to accept whatever limited interest rates options that the bank offers. The contradictory findings suggest that financial inclusion may affect the impact of interest rates on sustainable development.

Inflation was found to negatively affect sustainable development by hindering economic growth, potentially, because inflation decreases business investments by lowering real interest rates and savings. It also increases the cost of resources in production and decreases the efficiency with which productive factors are used. Barro (2013), similarly, found that the new growth theory also indicates a negative correlation between inflation and sustainable growth, possibly, because inflation tends to decrease the rate of technical change. Lyke and Ho (2019) also reported that inflation may hinder long-term and short-term sustainable development, in line with the Friedman-Ball hypothesis. Therefore, higher inflation levels correlate with uncertainties, which hamper the efficacy of the price mechanism and slows economic activities and development.

This present study also found a negative correlation between population growth and sustainable development, which was consistent with the findings of Güney (2017). It also echoed the findings of the World Bank that sustained and rapid population growth intensifies the challenge of ensuring the sustainability and inclusivity of social and economic development as low- and lower-middle-income countries, which constituted most of the studied countries, would hardly be able to afford an increase in public expenditure due to rapid population growth. At times, an expansion in public expenditure is necessary to decrease poverty, end hunger, and ensure universal access to health care systems, formal education, and other social services. Ensuring sustainable food security is an essential part of the SDGs. An increase in population size with less agricultural land and a growing strain on natural resources will add to the challenges of sustainable food security. Cleland and Machiyama (2017) also found that economic growth in sub-Saharan Africa was buoyant due to its rapidly growing population and economic pressure. Although population growth translates to a larger

labour force, in terms of the financial peculiarities of each country, more individuals will suffer from financial exclusion when the percentage of financial inclusion remains the same but the population increases.

Conversely, the coefficient of trade openness was positive but not statistically significant, which suggests that trade openness did not influence sustainable development. Inspired by Rodriguez and Rodrik, (2000) who exposed controversy between trade and development, a study by Ulaşan (2015) concluded that a clear-cut correlation does not exist between trade and development. However, such a correlation may depend on many external and country-specific factors. The insignificant effect of trade openness on sustainable development could be because, although it is known to foster economic growth, it tends to disproportionately benefit the bottom of the pyramid but not necessarily all the poor in most emerging and developing economies (Dorn et al., 2022). Driven by outliers, trade openness also increases income inequality in the most advanced economies. Therefore, any additional trade openness may contribute to certain aspects of sustainable development but may not have a significant impact when all aspects of the SDGs are considered.

5. Concluding remarks

Financial inclusion has garnered the attention from scholars from across the globe for the economic benefits that it brings individuals, businesses, and sustainable growth. Although extant studies indicate that financial inclusion underlies sustainable development, there is a lack of empirical evidence on the finance-related aspects of the SDGs. While financial inclusion may not directly affect all the SDGs, the novelty of this present study was that it covered seven finance-related components of the SDGs, as specified by the World Bank. Achieving the seven key goals in the 2030 Agenda of the SDGs creates the conditions necessary for the sustainable development of humankind. Therefore, the purpose of this present study was to provide nuanced insights into the correlation between financial inclusion and the achievement of the SDGs.

Due to a lack of complete data on financial inclusion, an inverse Euclidean distance method was used to develop the financial inclusion index on the ground with the previous studies. An SGD index was developed by aggregating the proxies of the 1st, 2nd, 3rd, 5th, 8th, 9th, and 10th SDGs, which the World Bank has identified as finance-related. These two sets of indices and a cross-country analysis were used to re-examine to correlation between financial inclusion and sustainable development. The findings of this present study revealed that ending hunger (SDG2), reducing gender inequality (SDG5), and promoting economic growth (SDG8) were the primary channels through which financial inclusion correlate to sustainable development. There was a lack of immediate evidence that indicated that financial inclusion influenced other aspects of sustainable development; such as poverty reduction (SDG1), good health and well-being (SDG3), industry, innovation, and infrastructure (SDG9), and reducing inequality (SDG10). The missing correlation between financial inclusion and these SDGs could be explained by: (1) evidence from the literature, (2) different between the variables that this present study used and that of extant studies, and (3) the existence of mediating variables that were not taken into consideration. Furthermore, as sustainable

development is not only directly underpinned by financial inclusion alone, other indirect channels could influence it. Therefore, if a government intends to achieve a certain SDG, it should consider other factors which may affect an SDG; such as institutional quality, financial literacy, and infrastructure development.

The correlation between financial inclusion and the finance-related SGDs index was also examined. These findings contribute to a small but growing body of cross-country literature on the role of financial inclusion in promoting sustainable development. In line with the findings of recent studies, this present study found that financial inclusion was an important driver of sustainable development (based on the finance-related SDG index) in the studied countries (Churchill & Marisetty, 2020; Niaz, 2022). It is suggested that financial inclusion lays the foundation for progressing towards this set of globally interlinked objectives. Therefore, financial inclusion should be prioritised when coordinating efforts to achieve the SDGs, be it in developed or developing countries.

This evidence provides important policy implications as the implementation of financial inclusion in developed and developing countries is deemed an appropriate strategy for promoting sustainable development. Firstly, financial sector policies that promote sustainable development should be prioritised when developing more inclusive financial systems that directly benefit the poor and low-income groups by increasing access to suitable financial services. Secondly, it is critical that countries assign equal importance to all the SGDs, without any preferences, to achieve sustainable development. Prioritising financial services does not remove resources from the other priorities that were set using the SGDs. In fact, financial inclusion helps achieve the SGDs in its entirety. Thirdly, although the results of this present study indicate that financial inclusion is a viable policy option for promoting sustainable development, the level of development of a country should also be taken into consideration. Policymakers must wisely plan their financial blueprints to make the financial system not only compelling but also inclusive. Lastly, financial policies alone are insufficient to achieve sustainable development as some mediating factors may affect the correlation between the two. Therefore, efforts to promote financial inclusion should be supported by policies that foster financial literacy and enhance infrastructure.

In terms of the theoretical implications, testing the correlation between the finance-related SDGs, financial inclusion, and sustainable development has resulted in the development of a new framework that extends the existing models in sustainable development literature. Integrating individual and aggregated finance-related SDGs in the correlation has yielded fresh and novel perspectives on the empirical evidence-based assertions of the theory. Solow's economic growth theory suggests that sustained economic growth is crucial for achieving the SDGs. Financial inclusion can contribute to investments; such as capital accumulation, technological progress, and the growth of the labour force; which would help end hunger, decrease gender inequality, and promote economic growth. Therefore, Solow's economic growth theory, financial inclusion, and Sustainable Development Goals are all interrelated and may be used as a framework that encourages long-term economic growth.

The limitation of this present study is that differences in the literacy rates, religion status, gender inequality, and natural resources of the regions in Asia, Africa, Latin America, and Europe were not taken into consideration even though they may affect

the level of financial inclusion in each country. Furthermore, this present study may have underestimated the role of other types of financial services; such as pensions or insurance.

In conclusion, the findings were credible as the variables of interest were consistent throughout the robustness analyses. Future studies may extend this present study in many ways. For instance, the role of financial inclusion in sustainable development could be examined by embedding institutional qualities from political, economic, and legal perspectives. Furthermore, other mediating factors; such as financial literacy and infrastructure development; are keys in deciding the path towards sustainable development. This is because, to achieve the interlinked goals, access to finance is simply the beginning. The more enhanced phase will be society's reaction and behaviour towards the use of the financial tools to achieve the SDGs. Lastly, other types of financial services should be taken into consideration as different types of financial services could have different effects on the studied countries.

Acknowledgment

The research was supported by the Ministry of Higher Education (MoHE), through the Fundamental Research Grant Scheme (FRGS/1/2021/SS01/UTAR/02/4) and by Universiti Tunku Abdul Rahman, through UTAR Research Fund (IPSR/RMC/UTARRF/2021-C1/L02).

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Shen Yap  <http://orcid.org/0009-0006-2790-7093>

Hui Shan Lee  <http://orcid.org/0000-0003-1017-3434>

Ping Xin Liew  <http://orcid.org/0000-0001-8043-704X>

References

- Achugamonu, U. B., Adetiloye, K. A., Adegbite, E. O., Babajide, A. A., & Akintola, F. A. (2020). Financial exclusion of bankable adults: Implication on financial inclusive growth among twenty-seven SSA countries. *Cogent Social Sciences*, 6(1), 1730046. <https://doi.org/10.1080/23311886.2020.1730046>
- Allard, G., & Williams, C. (2020). National-level innovation in Africa. *Research Policy*, 49(7), 104074. <https://doi.org/10.1016/j.respol.2020.104074>
- Allen, C., Metternicht, G., & Wiedmann, T. (2018). Initial progress in implementing the sustainable development goals (SDGs): A review of evidence from countries. *Sustainability Science*, 13(5), 1453–1467. <https://doi.org/10.1007/s11625-018-0572-3>
- Antle, J. M., & Diagana, B. (2003). Creating incentives for the adoption of sustainable agricultural practices in developing countries: The role of soil carbon sequestration. *American Journal of Agricultural Economics*, 85(5), 1178–1184. <https://doi.org/10.1111/j.0092-5853.2003.00526.x>
- Barro, R. J. (2013). Inflation and economic growth. *Annals of Economics & Finance*, 14(1), 85–109.
- Bovbjerg, R., & Hadley, J. (2007). *Why health insurance is important*. Health Policy Briefs. The Urban Institute.

- Burgess, R., & Pande, R. (2005). Do rural banks matter? Evidence from the Indian social banking experiment. *American Economic Review*, 95(3), 780–795. <https://doi.org/10.1257/0002828054201242>
- Cai, B., Shi, F., Huang, Y., & Abatechane, M. (2021). The impact of agricultural socialized services to promote the farmland scale management behaviour of smallholder farmers: Empirical evidence from the rice-growing region of Southern China. *Sustainability*, 14(1), 316. <https://doi.org/10.3390/su14010316>
- Chatzky, A., & McBride, J. (2020). *China's massive belt and road initiative*. Council Foreign Relations. <https://www.cfr.org/backgrounder/chinas-massive-belt-and-road-initiative>
- Cheston, S., & Kuhn, L. (2002). Empowering women through microfinance. *Draft, Opportunity International*, 64, 1–64.
- Churchill, S. A., & Marisetty, V. B. (2020). Financial inclusion and poverty: A tale of forty-five thousand households. *Applied Economics*, 52(16), 1777–1788. <https://doi.org/10.1080/00036846.2019.1678732>
- Cleland, J., & Machiyama, K. (2017). The challenges posed by demographic change in sub-Saharan Africa: A concise overview. *Population and Development Review*, 43, 264–286. <https://doi.org/10.1111/padr.170>
- De Haan, J., & Sturm, J. E. (2017). Finance and income inequality: A review and new evidence. *European Journal of Political Economy*, 50, 171–195. <https://doi.org/10.1016/j.ejpoleco.2017.04.007>
- Demirgüç-Kunt, A., Klapper, L., & Singer, D. (2017). *Financial inclusion and inclusive growth: A review of recent empirical evidence*. Policy Research Working Paper 8040, The World Bank.
- Dorn, F., Fuest, C., & Potrafke, N. (2022). Trade openness and income inequality: New empirical evidence. *Economic Inquiry*, 60(1), 202–223. <https://doi.org/10.1111/ecin.13018>
- Dupas, P., & Robinson, J. (2013). Savings constraints and microenterprise development: Evidence from a field experiment in Kenya. *American Economic Journal: Applied Economics*, 5(1), 163–192. <https://doi.org/10.1257/app.5.1.163>
- Forgeard, M. J. C., Jayawickreme, E., Kern, M. L., & Seligman, M. E. P. (2011). Doing the right thing: Measuring wellbeing for public policy. *International Journal of Wellbeing*, 1(1), 79–106. <https://doi.org/10.5502/ijw.v1i1.15>
- García-Herrero, A., & Turégano, D. M. (2018). Financial inclusion, rather than size, is the key to tackling income inequality. *The Singapore Economic Review*, 63(01), 167–184. <https://doi.org/10.1142/S0217590818410047>
- Goetz, A. M., & Gupta, R. S. (1996). Who takes the credit? Gender, power, and control over loan use in rural credit programs in Bangladesh. *World Development*, 24(1), 45–63. [https://doi.org/10.1016/0305-750X\(95\)00124-U](https://doi.org/10.1016/0305-750X(95)00124-U)
- Gopalan, S., & Rajan, R. S. (2018). Foreign banks and financial inclusion in emerging and developing economies: An empirical investigation. *Journal of International Development*, 30(4), 559–583. <https://doi.org/10.1002/jid.3354>
- Gujarati, D. N., & Porter, D. (2009). *Basic econometrics*. McGraw-Hill International Edition.
- Güney, T. (2017). Population growth and sustainable development in develop-developing countries: An IV (2SLS) Approach. *The Journal of Faculty of Economics and Administrative Sciences*, 22(4), 1255–1277.
- Honohan, P. (2008). Cross-country variation in household access to financial services. *Journal of Banking & Finance*, 32(11), 2493–2500. <https://doi.org/10.1016/j.jbankfin.2008.05.004>
- Inoue, T., & Hamori, S. (2012). How has financial deepening affected poverty reduction in India? Empirical analysis using state-level panel data. *Applied Financial Economics*, 22(5), 395–408. <https://doi.org/10.1080/09603107.2011.613764>
- Inoue, T. (2019). Financial inclusion and poverty reduction in India. *Journal of Financial Economic Policy*, 11(1), 21–33. <https://doi.org/10.1108/JFEP-01-2018-0012>
- Khan, A., Hashim, S., Khan, S. Z., & Khan, M. S. (2021). Impact of financial inclusion on economic development of Pakistan (An application of SEM). *Elementary Education Online*, 20(2), 1469–1469.

- Klapper, L., El-Zoghbi, M., & Hess, J. (2016). *Achieving the sustainable development goals: The role of financial inclusion*. CGAP.
- Kuada, J. (2019). *Financial inclusion and the sustainable development goals. Extending financial inclusion in Africa*, Academic Press.
- Laha, A., & Sen, A. (2021). Relationship of financial inclusion and physical quality of life: Evidences from SAARC countries. *International Journal of Economic Policy in Emerging Economies*, 14(3), 248–268. <https://doi.org/10.1504/IJEPEE.2021.114961>
- Lashitew, A. A., Tulder, R. V., & Liasse, Y. (2019). Mobile phones for financial inclusion: What explains the diffusion of mobile money innovations? *Research Policy*, 48(5), 1201–1215. <https://doi.org/10.1016/j.respol.2018.12.010>
- Levine, R. (2005). Finance and growth: Theory and evidence. *Handbook of Economic Growth*, 1, 865–934.
- Lyke, B. N., & Ho, S. Y. (2019). Inflation, inflation uncertainty, and growth: Evidence from Ghana. *Contemporary Economics*, 13(2), 123–136. <https://doi.org/10.5709/ce.1897-9254.303>
- Miller, C., & Jones, L. (2010). *Agricultural value chain finance: Tools and lessons*. Practical Action Publishing.
- Niaz, M. U. (2022). Socio-Economic development and sustainable development goals: A road-map from vulnerability to sustainability through financial inclusion. *Economic Research-Ekonomika Istraživanja*, 35(1), 3243–3275. <https://doi.org/10.1080/1331677X.2021.1989319>
- Ohiomu, S., & Ogbeide-Osaretin, E. N. (2019). Financial inclusion and gender inequality reduction: Evidence from sub-Saharan Africa. *The Indian Economic Journal*, 67(3-4), 367–372. <https://doi.org/10.1177/0019466220946411>
- Omar, M. A., & Inaba, K. (2020). Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis. *Journal of Economic Structures*, 9(1), 1–25. <https://doi.org/10.1186/s40008-020-00214-4>
- Ouechtati, I. (2020). The contribution of financial inclusion in reducing poverty and income inequality in developing countries. *Asian Economic and Financial Review*, 10(9), 1051–1061. <https://doi.org/10.18488/journal.aefr.2020.109.1051.1061>
- Ozili, P. K. (2022). Financial inclusion and sustainable development: An empirical association. *Journal of Money and Business*, 2(2), 186–198. <https://doi.org/10.1108/JMB-03-2022-0019>
- Park, C. Y., & Mercado, R. (2015). *Financial inclusion, poverty, and income inequality in developing Asia*. Asian Development Bank Economics Working Paper Series (426).
- Park, C. Y., & Mercado, R. (2018). *Financial inclusion: New measurement and cross-country impact assessment*. Asian Development Bank Economics Working Paper Series, 539. <https://www.adb.org/sites/default/files/publication/408621/ewp-539-financial-inclusion.pdf>
- Peng, J., & Xu, X. (2019). The coupling relationship and coordinated development between agricultural industrialization and inclusive finance – A case study of Hunan province. *The Theory and Practice of Finance and Economics*, 5, 19–26.
- Polloni-Silva, E., da Costa, N., Moralles, H. F., & Sacomano Neto, M. (2021). Does financial inclusion diminish poverty and inequality? A panel data analysis for Latin American countries. *Social Indicators Research*, 158(3), 889–925. <https://doi.org/10.1007/s11205-021-02730-7>
- Qamruzzaman, M., & Wei, J. (2019). Financial innovation and financial inclusion nexus in south Asian countries: Evidence from symmetric and asymmetric panel investigation. *International Journal of Financial Studies*, 7(4), 61. <https://doi.org/10.3390/ijfs7040061>
- Robino, C., Trivelli, C., Villanueva, C., Sachetti, F. C., Walbey, H., Martinez, L., & Marincioni, M. (2018). *Financial inclusion for women: A way forward*. G20 Insights. https://www.g20-insights.org/policy_briefs/financial-inclusion-for-women-a-way-forward/
- Rodriguez, F., & Rodrik, D. (2000). Trade policy and economic growth: A skeptic's guide to the cross-national evidence. *NBER Macroeconomics Annual*, 15, 261–325. <https://doi.org/10.1086/654419>
- Sakya-Nyarko, C., Ahmad, A. H., & Green, C. J. (2022). Investigating the well-being implications of mobile money access and usage from a multidimensional perspective. *Review of Development Economics*, 26(2), 985–1009. <https://doi.org/10.1111/rode.12848>
- Sarma, M. (2008). *Index of financial inclusion*. (No. 215). Working paper.

- Shi, Y., Gong, L., & Chen, J. (2019). The effect of financing on firm innovation: Multiple case studies on Chinese manufacturing enterprises. *Emerging Markets Finance and Trade*, 55(4), 863–888. <https://doi.org/10.1080/1540496X.2018.1478284>
- Staveren, I. V. (2001). Gender biases in finance. *Gender & Development*, 9(1), 9–17. <https://doi.org/10.1080/13552070127734>
- Sujianto, A. E., Pantas, P. E., Mashudi, M., Pambudi, D. S., & Narmaditya, B. S. (2020). Do real interest rate, gross domestic savings and net exports matter in economic growth? Evidence from Indonesia. *The Journal of Asian Finance, Economics and Business*, 7(11), 127–135. <https://doi.org/10.13106/jafeb.2020.vol7.no11.127>
- Tran, H. T. T., & Le, H. T. T. (2021). The impact of financial inclusion on poverty reduction. *Asian Journal of Law and Economics*, 12(1), 95–119. <https://doi.org/10.1515/ajle-2020-0055>
- Ulaşan, B. (2015). Trade openness and economic growth: Panel evidence. *Applied Economics Letters*, 22(2), 163–167. <https://doi.org/10.1080/13504851.2014.931914>
- Van, L. T. H., Vo, A. T., Nguyen, N. T., & Vo, D. H. (2021). Financial inclusion and economic growth: An international evidence. *Emerging Markets Finance and Trade*, 57(1), 239–263. <https://doi.org/10.1080/1540496X.2019.1697672>
- World Bank. (2017). *The global finindex database 2017*. The World Bank Group. <https://global-finindex.worldbank.org/>
- World Bank. (2022). *Financial inclusion*. The World Bank Group. <https://www.worldbank.org/en/topic/financialinclusion/overview>
- Yikun, Z., Woon Leong, L., Cong, P. T., Abu-Rumman, A., Al Shraah, A., & Hishan, S. S. (2023). Green growth, governance, and green technology innovation. How effective towards SDGs in G7 countries? *Economic Research-Ekonomska Istraživanja*, 36(2), 1–19. <https://doi.org/10.1080/1331677X.2022.2145984>
- Zhang, Q., & Posso, A. (2017). Microfinance and gender inequality: Cross-country evidence. *Applied Economics Letters*, 24(20), 1494–1498. <https://doi.org/10.1080/13504851.2017.1287851>
- Zhuang, J., Gunatilake, H. M., Niimi, Y., Khan, M. E., Jiang, Y., Hasan, R., & Huang, B. (2009). *Financial sector development, economic growth, and poverty reduction: A literature review*. Asian Development Bank Economics Working Paper Series (173).