

Financial inclusion and sustainable development: an empirical association

Peterson K. Ozili
Central Bank of Nigeria, Abuja, Nigeria

Received 31 March 2022
Revised 20 August 2022
Accepted 20 August 2022

Abstract

Purpose – This paper aims to investigate the association between financial inclusion and sustainable development in a global context.

Design/methodology/approach – The study used two datasets, and employed the Pearson correlation analysis and granger causality test to examine the correlation and pairwise causality between financial inclusion and sustainable development.

Findings – High levels of financial inclusion (in terms of higher commercial bank branches per 100,000 adults) is significantly associated with higher electricity production from renewable sources, higher industry productivity, higher adult literacy rate and higher renewable electricity output. Also, higher financial inclusion is significantly associated with low combustible renewables and waste. There is a uni-directional granger causality between global interest in internet information about sustainable development and global interest in internet information about financial inclusion, particularly in the period after the global financial crisis but before the COVID-19 pandemic.

Practical implications – The correlation between financial inclusion and sustainable development depends on the indicators employed to measure financial inclusion and sustainable development. The results support global calls for greater financial inclusion and the speedy attainment of the sustainable development goals for the good of all people, the environment and for the planet.

Originality/value – This paper is the first study in the literature to analyze the link between financial inclusion and sustainable development using global data. This study contributes to the existing literature by investigating the association between financial inclusion and sustainable development in a global context.

Keywords Financial inclusion, Sustainable development goals, Access to finance, Energy, Renewables, Adult literacy, Industry, Electricity, Access to finance, Unbanked adults, Environment

Paper type Research paper

1. Introduction

This paper empirically explores the association between financial inclusion and sustainable development.

Financial inclusion and sustainable development are two development agenda with far-reaching positive implications for society and the environment; as such, the two agendas have been the subject of intense investigation lately in the international development community. Recent research in financial inclusion and sustainable development shows that the two concepts have been investigated as separate mutually exclusive concepts without the possibility of establishing a link or association between the two agendas.

Financial inclusion is all about inclusiveness in the provision of affordable formal financial services to all individuals and businesses. Financial inclusion ensures that people and firms have access to basic and affordable financial services in the formal financial sector (Liu *et al.*, 2021; Ozili, 2021a, d). Existing research shows evidence that financial inclusion



programs can help to bring the excluded population, or unbanked adults, into the formal financial sector in countries where there are large numbers of unbanked adults. Sustainable development, on the other hand, is all about development that meets the needs of the present without compromising the ability of future generations to meet their needs (Rees, 1989). Sustainable development is concerned about ensuring that today's resources are not significantly depleted or destroyed to the detriment of future generations who will need them. Sustainable development is often analyzed under three broad dimensions, namely, the economic dimension, environmental dimension and social dimension (Alaimo *et al.*, 2021).

The link between financial inclusion and sustainable development is exemplified by the economic and social benefits that financial inclusion brings to individuals, firms and government in the pursuit of sustainability. The interconnection between financial inclusion and sustainable development can also be perceived when financial inclusion policies are implemented through existing economic and social structures that are essential for sustainable development. These economic and social structures often provide the channels through which providers of financial services reach unbanked adults and serve banked customers. Given this perceived interrelationship, discussions of the link between financial inclusion and sustainable development is important and should be encouraged among academics, practitioners and policy makers.

Using data from the World Development Indicators and data from Google Trend database, the findings show that there is a uni-directional granger causality between global interest in internet information about sustainable development and global interest in internet information about financial inclusion in the period after the global financial crisis (GFC) but before the COVID-19 pandemic. Also, financial inclusion is positively correlated with electricity production from renewable sources, industry productivity, adult literacy rate and renewable electricity output. Also, financial inclusion is negatively correlated with low combustible renewables and waste.

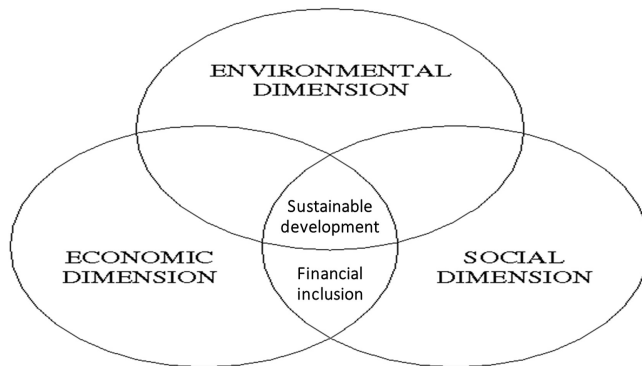
This study makes some contribution to the literature. This study contributes to the sustainable development literature. It contributes to studies that investigate the determinants of sustainable development. This study also contributes to the literature that seek ways to achieve the United Nation's sustainable development goals. This paper further contributes to the financial inclusion literature. It contributes to the financial inclusion literature by positioning the financial inclusion agenda within the broader sustainable development agenda. Finally, while many studies exist on the link between financial inclusion and several dimensions of development, there are very few studies on the link between financial inclusion and sustainable development. This study adds to the literature by analyzing the link between financial inclusion and sustainable development using global data.

The rest of the paper is structured as follows. Section 2 presents a framework that connects financial inclusion and sustainable development. Section 3 presents the literature review. Section 4 presents a discussion of the link between financial inclusion and sustainable development. Section 5 presents the empirical results. Section 6 concludes.

2. A framework connecting financial inclusion and sustainable development

As mentioned earlier, financial inclusion is all about inclusiveness in the provision of affordable formal financial services to all individuals and businesses, while sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs (Rees, 1989). Sustainable development has three broad dimensions, namely, the economic dimension, environmental dimension and social dimension (Alaimo *et al.*, 2021). Figure 1 demonstrates that financial inclusion meets sustainable development at the intersection of the economic and social dimensions of sustainable development. The economic dimension of sustainable development is related to

Figure 1.
Linking financial
inclusion to
sustainable
development



Source(s): Author

financial inclusion because providers of formal financial services, such as financial institutions, can reach out to unbanked adults in the community, bring them to the formal financial sector through account ownership schemes, provide affordable financial services to them and offer them a variety of services that will improve their economic conditions. This will not only improve the welfare of banked adults but will increase the profitability of financial institutions and contribute to job creation and higher economic growth. The social dimension of sustainable development is also related to financial inclusion as shown in Figure 1. This is because providers of formal financial services must deal with banked adults with care, respect and treat them fairly through fair pricing of basic financial products and services, avoiding racial discrimination and racial profiling when serving banked customers and going the extra mile to serve banked customers that have uncommon financial needs.

Another way to look at the link between financial inclusion and sustainable development is from the policy perspective. Policy efforts to achieve financial inclusion are mostly channeled through financial institutions who are part of the existing economic and social system. Financial inclusion and sustainable development are interconnected when financial inclusion policies are implemented through financial institutions that operate within existing economic and social system that are essential for sustainable development.

Examples of financial inclusion policy actions that could be attributed to the economic dimension of sustainable development include (1) the issuance of new licenses to micro finance institutions to do business in remote areas in an effort to reach unbanked adults and (2) regulatory approvals for the expansion of bank branch network to reach a larger number of unbanked adults in specific locations. These two policy actions can increase employment and also increase access to finance. Examples of financial inclusion policy actions that could be attributed to the social dimension of sustainable development include (1) regulatory interventions to lower the high cost of banking services, (2) reducing the number of foreign banks in the domestic country and (3) issuing regulations that compel financial institutions to employ people in the community they operate from.

Positioning financial inclusion at the point of intersection of the economic and social dimensions of sustainable development will mean that financial inclusion efforts should take into account both economic and social considerations. Financial institutions, who are the providers of financial services, may need to put social considerations first before profit when serving banked customers and when reaching out to unbanked adults. This can make financial services become more meaningful to members of society, it can increase social trust in financial institutions and can align financial inclusion goals with sustainable development goals.

The interdependence between the financial inclusion and sustainable development needs full recognition. Such recognition can translate into policies and actions that recognize the role of financial inclusion in the sustainable development agenda. It is well established that financial inclusion plays a crucial role in financial development. In fact, many studies have associated high levels of financial inclusion with high levels of financial development (Adeola and Evans, 2017; Allen *et al.*, 2014; Alter and Yontcheva, 2015). Yet, there is little research on the interface between financial inclusion and sustainable development for sustainability. Further research is needed to explore contemporary issues that require the interface between financial inclusion and sustainable development. The growing interest in financial inclusion and sustainable development around the world shows that knowledge about financial inclusion and sustainable development is important not only because of its potential to reduce poverty and preserve resources, but also because of its socio-economic and eco-economic benefits. Development researchers must lead the development of a research agenda that considers the combined role of financial inclusion and sustainable development in making the world a better place.

3. Literature review

Recent studies show that financial inclusion has become a top policy priority in many countries (Cull *et al.*, 2021; Dabla-Norris *et al.*, 2021; Vo *et al.*, 2021; Ozili, 2021c). The priority given to financial inclusion by governments is hinged on substantial research that shows evidence that financial inclusion promotes economic growth (Kim *et al.*, 2018), greater financial stability (Neaime and Gaysset, 2018), poverty reduction (Koomson *et al.*, 2020), reduction in income inequality (Huang and Zhang, 2020) and mitigating financial risk (Ozili, 2021b), among others. Other studies identify some determinants of financial inclusion such as digital finance (Ozili, 2018), financial literacy (Grohmann *et al.*, 2018), financial regulation (Anarfo and Abor, 2020), economic policy uncertainty (Ozili, 2022), etc.

Some studies examine financial inclusion along several dimensions of development. For instance, Bayar *et al.* (2021) analyze how the usage of primary energy is affected by financial sector development and access to finance. They analyze a sample of European Union (EU) transition countries from 1996 to 2017 using panel co-integration and causality tests that allow for cross-section dependence. They find that access to finance is negatively associated with primary energy usage. Dakhliya *et al.* (2021) examine the link between financial inclusion and ethnic development. They use a meso-level perspective and analyze eleven ethnic groups in Nigeria and Senegal. They find a significant positive link between ethnic financial inclusion and local economic prosperity. Kandpal (2020) show that despite government intervention programs for financial inclusion in India, some rural segments of the population are still unaware of financial institutions in their community. Rumbogo *et al.* (2021) investigate the role of financial inclusion for inclusive development in Indonesia. They find that financial access is significantly and positively associated with the level of regional economic development in Indonesia. Zaidi *et al.* (2021) analyze the linkages between financial inclusion, energy consumption and carbon emission using data of 23 Organisation for Economic Co-operation and Development (OECD) countries from 2004 to 2017. The results indicate positive connections between financial inclusion, energy consumption and carbon emission.

Cabeza-García *et al.* (2019) investigate the effect of female financial inclusion on inclusive economic development. They argue that when women participate in the financial system, the inequality gap decreases, which also increases both physical and social well-being, thereby increasing women's economic development. In their empirical analysis based on data from the Global Findex database and the World Bank DataBank, they find that greater financial inclusion of women, measured as access to a bank account and access to credit cards, has a

positive effect on economic development. [Huang et al. \(2021\)](#) investigate the impact of financial inclusion and trade openness on the economic development of 27 EU nations from 1995 to 2015. They find that access, depth, efficiency and the overall development of financial institutions have a significant positive impact on economic growth. They also find that the impact of financial inclusion on economic output is more significant in low-income and new-EU member countries than in high-income and old-EU countries. [Matekenya et al. \(2021\)](#) examine the effect of financial inclusion on human development in Sub-Saharan Africa (SSA). They argue that access to financial services and the use of financial services may encourage business start-ups, allow individuals to invest in health and education, manage risk and lessen the burden of financial shocks and therefore, improve human development. They conduct a panel generalized method of moments regression analysis and find that financial inclusion has a positive effect on human development. [Cicchello et al. \(2021\)](#) investigate the relationship between a financial inclusion index and development variables in 42 least developed countries in Asia and Africa from 2000 to 2019. They find that economic growth leads to financial inclusion. They also observe that unemployment and literacy rates are among the factors contributing to financial inclusion. They also observe that income inequality reduces financial inclusion rates and has a negative impact on development. [Anarfo et al. \(2019\)](#) investigate the link between financial inclusion and financial sector development in SSA. They find a reverse causality between financial sector development and financial inclusion in SSA countries sample. Their findings suggest that financial inclusion is a driver of financial sector development and vice versa. [Ade'Soyemi et al. \(2020\)](#) evaluate the impact of financial inclusion on sustainable development from 2001 to 2016. They use an error correction model (ECM) and a fully modified ordinary least squares (FMOLS) analysis to determine the short-run relationship between the variables. The result of the analysis indicates that there is short-run causality running from commercial bank branches to human development index. [Lenka \(2021\)](#) investigates the linkages between financial inclusion and financial development in India from 1980 to 2017. The author used the principal component analysis methodology to construct both financial inclusion index and financial development index. The author finds that there is a unidirectional relationship between financial inclusion and financial development in India. The implication is that financial inclusion is an essential determinant of financial sector development in a developing country like India.

While many studies exist on the link between financial inclusion and several dimensions of development, there are very few studies on the link between financial inclusion and sustainable development. This study adds to the literature by analyzing the link between financial inclusion and sustainable development using global data.

4. Research methodology

4.1 Data

The study used two datasets. The first dataset consists of data collected from the world development indicators for the World region from the 2001 to 2020. The data collected (reported in [Table 1](#)) include data on commercial bank branches per 100,000 adults (CBB); combustible renewables and waste (CRW); electricity production from renewable sources (ELC); industry value added (IND); adult literacy rate (LIT); renewable electricity output (RNW); renewable energy consumption (RNT); research and development expenditure (RDE); CO₂ emissions from electricity and heat production (COE); and CO₂ emissions from gaseous fuel consumption (COG). The second dataset consist of monthly global data collected from Google Trends database from January 2004 to December 2021. The Google Trends data measure global interest over time in financial inclusion and sustainable development. Data were collected for two variables, namely, the “global interest in Internet information about financial inclusion (FIN)” and “global interest in Internet information about sustainable

Indicators	Meaning	Indicator of	Predicted sign with financial inclusion	Source
CBB	Commercial bank branches (per 100,000 adults)	Financial inclusion		World Development Indicators
CRW	Combustible renewables and waste (% of total energy)	Sustainable development	+	World Development Indicators
ELC	Electricity production from renewable sources, excluding hydroelectric (% of total)	Sustainable development	+	World Development Indicators
IND	Industry (including construction), value added (% of GDP)	Sustainable development	+	World Development Indicators
LIT	Literacy rate, adult total (% of people ages 15 and above)	Sustainable development	+	World Development Indicators
RNW	Renewable electricity output (% of total electricity output)	Sustainable development	+	World Development Indicators
RNT	Renewable energy consumption (% of total final energy consumption)	Sustainable development	+	World Development Indicators
RDE	Research and development expenditure (% of GDP)	Sustainable development	+	World Development Indicators
COE	CO2 emissions from electricity and heat production, total (% of total fuel combustion)	Sustainable development	-	World Development Indicators
COG	CO2 emissions from gaseous fuel consumption (% of total)	Sustainable development	-	World Development Indicators
FIN	Global interest in internet information about financial inclusion	Global interest over time in financial inclusion		Google Trends database
SD	Global interest in internet information about sustainable development	Global interest over time in sustainable development		Google Trends database

Table 1.
Variable description and source

development (SD).” During data collection, I query the Google Trends database by inserting the keywords “sustainable development” and “financial inclusion” into the Google Trends database. The resulting data are what we refer to as “global interest in Internet information about sustainable development” and “global interest in Internet information about financial inclusion.”

4.2 Model

The model estimates the association between financial inclusion and sustainable development.

$$\text{Financial inclusion} = f(\text{sustainable development})$$

$$\text{Sustainable development} = f(\text{financial inclusion})$$

The model is analyzed using Pearson correlation test statistic, which measures the correlation between the financial inclusion and sustainable development. The data were also analyzed using granger causality to determine whether financial inclusion causes sustainable development or whether sustainable development causes financial inclusion and sustainable development.

5. Empirical results

5.1 Correlation of financial inclusion with sustainable development indicators

The correlation result is reported in Table 2. As can be observed, the financial inclusion variable, CBB, is significant and positively correlated with ELC, IND, LIT, RNW and COE. The correlation of CBB with ELC, IND, LIT, RNW and COE is above 60% in each case. The high correlation indicates that high levels of financial inclusion (in terms of higher commercial bank branches per 100,000 adults) is significantly associated with higher electricity production from renewable sources, higher industry productivity, higher adult literacy rate, greater renewable electricity output and greater CO2 emissions from electricity and heat production. Table 2 also shows that the financial inclusion variable, CBB, is significant and negatively correlated with CRW. The correlation of CBB with CRW is 81.7%, which is greater than 60%. The high correlation indicates that high levels of financial inclusion (in terms of higher commercial bank branches per 100,000 adults) is associated with low combustible renewables and waste. Meanwhile, the financial inclusion variable, CBB, is not significantly correlated with RNT, RDE and COG. This indicates that financial inclusion (in terms of commercial bank branches per 100,000 adults) is not significantly associated with renewable energy consumption, research and development expenditure and CO2 emissions from gaseous fuel consumption. Overall, the correlation result suggests that financial inclusion is significant and positively correlated with some indicators of sustainable development, and is also significant and negatively correlated with some indicators of sustainable development. This suggests that the significance of the correlation or association

Variables	CBB	CRW	ELC	IND	LIT	RNW	RNT	RDE	COE	COG
CBB	1.000									
CRW	-0.869*** (-5.26) (0.00)	1.000 -								
ELC	0.788*** (3.84) (0.00)	-0.940*** (-8.30) (0.00)	1.000							
IND	0.660** (2.64) (0.02)	-0.604** (-2.27) (0.05)	0.361 (1.16) (0.27)	1.000						
LIT	0.789*** (3.85) (0.00)	-0.958*** (-10.13) (0.00)	0.982*** (15.82) (0.00)	0.392 (1.28) (0.23)	1.000					
RNW	0.741*** (3.31) (0.01)	-0.901*** (-6.25) (0.00)	0.993*** (26.22) (0.00)	0.285 (0.89) (0.39)	0.969*** (11.95) (0.00)	1.000				
RNT	0.403 (1.32) (0.22)	-0.567** (-2.06) (0.06)	0.782*** (3.76) (0.00)	-0.231 (-0.71) (0.49)	0.772*** (3.64) (0.00)	0.833*** (4.52) (0.00)	1.000			
RDE	0.402 (1.32) (0.22)	-0.611** (-2.31) (0.04)	0.708*** (3.01) (0.01)	-0.042 (-0.12) (0.90)	0.751*** (3.41) (0.01)	0.746*** (3.36) (0.01)	0.818*** (4.26) (0.00)	1.000		
COE	0.817*** (4.26) (0.00)	-0.905*** (-6.41) (0.00)	0.801*** (4.01) (0.00)	0.733*** (3.23) (0.01)	0.809*** (4.13) (0.00)	0.748*** (3.38) (0.01)	0.339 (1.08) (0.31)	0.325 (1.03) (0.32)	1.000	
COG	0.136 (0.41) (0.68)	-0.482 (-1.65) (0.13)	0.545* (1.95) (0.08)	-0.00 (-0.00) (0.99)	0.587** (2.17) (0.05)	0.567* (2.04) (0.07)	0.563** (2.87) (0.07)	0.69*** (2.87) (0.00)	0.165 (0.50) (0.62)	1.000

Table 2.
Pearson correlation matrix

between financial inclusion and sustainable development depends on the indicators employed to measure financial inclusion and sustainable development.

5.2 Granger causality

5.2.1 Unit root test. The augmented Dickey–Fuller (ADF) unit root test in Table 3 shows that the time-series data for global interest in internet information about SD are stationary only during the pandemic because the p -value is less than 5%, while the time-series data for global interest in internet information about financial inclusion (FIN) are stationary during the COVID-19 pandemic, during the GFC and during the period after the GFC but before the COVID-19 pandemic. Finally, for the time-series data that are non-stationary, the time series is transformed by taking the first difference of the time series data.

5.2.2 Causality test. Table 4 reports evidence of uni-directional granger causality between global interest in internet information about sustainable development and global interest in internet information about financial inclusion in the period after the GFC but before the COVID-19 pandemic. The p -value is 0.002, and this leads to the rejection of the null hypothesis. This indicates that global interest in internet information about sustainable development granger cause (or lead to) global interest in internet information about financial inclusion in the period after the GFC but before the COVID-19 pandemic. This implies that there is a

Sub-sample	Variable	t -statistic (p -value)	Remark
Period before GFC	FIN	-0.696 (0.837)	Has a unit root; time-series data are non-stationary
	SD	-1.639 (0.454)	Has a unit root; time-series data are non-stationary
During the GFC	FIN	-4.764 (0.002)	Does not have unit root; time-series data are stationary
	SD	-2.482 (0.136)	Has a unit root; time-series data are non-stationary
After the global financial crisis but before COVID-19	FIN	-2.974 (0.040)	Does not have unit root; time-series data are stationary
	SD	1.081 (0.997)	Has a unit root; time-series data are non-stationary
During COVID-19	FIN	-3.239 (0.031)	Does not have unit root; time-series data are stationary
	SD	-3.637 (0.013)	Does not have unit root; time-series data are stationary

Note(s): Schwarz information criterion (SIC) is applied. Maximum five lags. Test for unit root in level. FIN = global interest in Web search information about financial inclusion. SD = global interest in Web search information about sustainable development

Table 3.
ADF unit root test

Pairwise granger causality tests

Period: Jul 2009–Dec 2019

Lags: 2

Null hypothesis	Obs	F -statistic	Prob
D(SD) does not granger cause FIN	123	6.630	0.002
FIN does not granger cause D(SD)		0.447	0.641

Table 4.
Granger causality (after the GFC but before COVID-19 pandemic)

one-way causality between global interest in internet information about the sustainable development and global interest in internet information about financial inclusion. This means that there is no feedback causation in this relationship because the p -value of 0.641 indicates that global interest in internet information about financial inclusion does not granger cause global interest in internet information about sustainable development in the period after the GFC but before the COVID-19 pandemic. By contrast, there is no granger causality between global interest in internet information about financial inclusion and global interest in internet information about sustainable development in the period before the GFC (Table 5), during the GFC (Table 6) and during the COVID-19 pandemic in Table 7.

5.3 Correlation of interest in financial inclusion and sustainable development

The correlation result is reported in Tables 8–11. Table 8 shows that global interest in internet information about financial inclusion is significant and negatively correlated with global interest in internet information about sustainable development in the period before the GFC. Table 9 shows that global interest in Internet information about financial inclusion is not significantly correlated with global interest in internet information about sustainable development in the period during the GFC. Table 10 shows that global interest in internet information about financial inclusion is significant and positively correlated with global interest in internet information about sustainable development in the period after the GFC but before the COVID-19 pandemic. Table 11 shows that global interest in internet information about financial inclusion is not significantly correlated with global interest in internet information about sustainable development in the period during the GFC. Overall, the

Pairwise granger causality tests
Period: Jan 2004–Nov 2007
Lags: 2

Table 5.

Granger causality
(period before the GFC)

Null hypothesis	Obs	F-statistic	Prob
D(SD) does not granger cause D(FIN)	44	1.355	0.269
D(FIN) does not granger cause D(SD)		0.072	0.931

Pairwise granger causality tests
Sample: Dec 2007–Jun 2009
Lags: 2

Table 6.

Granger causality
(during the GFC)

Null hypothesis	Obs	F-statistic	Prob
D(SD) does not granger cause FIN	16	0.029	0.971
FIN does not granger cause D(SD)		0.397	0.682

Pairwise granger causality tests
Period: Jan 2020–Dec 2021
Lags: 2

Table 7.

Granger causality
(during the COVID-19
pandemic)

Null hypothesis	Obs	F-statistic	Prob
SD does not granger cause FIN	22	0.159	0.854
FIN does not granger cause SD		1.146	0.341

correlation result suggests that greater global interest in internet information about financial inclusion is associated with reduced global interest in internet information before the GFC, while greater global interest in internet information about financial inclusion is associated with greater global interest in internet information in the period after the GFC but before the COVID-19 pandemic.

Probability	FIN	SD
FIN	1.000	-0.472*** (-3.59) ((0.00))
SD	-0.472*** (-3.59) ((0.00))	1.000

Note(s): *t*-statistic is reported in single parenthesis. *p*-value is reported in double parenthesis. *** denotes statistical significance at 1%

Table 8.
Correlation analysis:
before the GFC

Variable	FIN	SD
FIN	1.000	0.091 (0.38) ((0.71))
SD	0.091 (0.38) ((0.71))	1.000

Note(s): *t*-statistic is reported in single parenthesis. *p*-value is reported in double parenthesis

Table 9.
Correlation analysis:
during the GFC

Variable	FIN	SD
FIN	1.000	0.251*** (2.89) ((0.00))
SD	0.251*** (2.89) ((0.00))	1.000

Note(s): *t*-statistic is reported in single parenthesis. *p*-value is reported in double parenthesis. *** denotes statistical significance at 1%

Table 10.
Correlation analysis:
after GFC but before
the COVID-19
pandemic

Variable	FIN	SD
FIN	1.000	0.306 (1.51) ((0.15))
SD	0.306 (1.51) ((0.15))	1.000

Note(s): *t*-statistic is reported in single parenthesis. *p*-value is reported in double parenthesis

Table 11.
Correlation analysis:
during the COVID-19
pandemic

6. Conclusion

This paper examined the association between financial inclusion and sustainable development. The paper developed a framework to understand the connection between financial inclusion and sustainable development. Thereafter, the paper examined the correlation between financial inclusion (in terms of commercial bank branches per 100,000 adults) and several indicators of sustainable development. The paper also examined the granger causality between global interest in internet information about financial inclusion and sustainable development. The study used data from the World Development Indicators as well as “interest over time” data from Google Trends database. The conceptual framework showed that financial inclusion and sustainable development meet at the intersection of the economic and social dimensions of sustainable development. This is because most financial inclusion goals are achieved through existing social and economic systems that contribute to sustainable development.

The empirical findings revealed that high levels of financial inclusion (in terms of higher commercial bank branches per 100,000 adults) is significantly associated with higher electricity production from renewable sources, higher industry productivity, higher adult literacy rate, higher renewable electricity output and higher CO₂ emissions from electricity and heat production. Also, higher commercial bank branches per 100,000 adults is associated with low combustible renewables and waste. There is a uni-directional granger causality between global interest in internet information about sustainable development and global interest in internet information about financial inclusion in the period after the GFC but before the COVID-19 pandemic.

The implication of the findings is that financial inclusion is positively correlated with sustainable development, and the correlation between financial inclusion and sustainable development depends on the indicators employed to measure financial inclusion and sustainable development. The results also show that greater interest in internet information about sustainable development granger causes greater interest in internet information about financial inclusion.

The results support the global movement toward greater financial inclusion and the attainment of the sustainable development goals for the good of all people, the environment and for the planet. There is a need to use policy tools and private sector partnership to increase the level of financial inclusion and for the attainment of the sustainable development goals. The result also supports calls to integrate financial inclusion into the sustainable development goals.

Future studies can examine the relationship between financial exclusion and sustainable development while focusing on micro-level indicators of financial exclusion. Other studies can examine the relationship between financial inclusion and other indicators of sustainable development that were not used in this study.

References

- Adeola, O. and Evans, O. (2017), “Financial inclusion, financial development, and economic diversification in Nigeria”, *The Journal of Developing Areas*, Vol. 51 No. 3, pp. 1-15.
- AdeSoyemi, K., Olowofela, O.E. and Yunusa, L.A. (2020), “Financial inclusion and sustainable development in Nigeria”, *Journal of Economics and Management*, Vol. 39 No. 1, pp. 105-131.
- Alaimo, L.S., Ciacci, A. and Ivaldi, E. (2021), “Measuring sustainable development by non-aggregative approach”, *Social Indicators Research*, Vol. 157 No. 1, pp. 101-122.
- Allen, F., Carletti, E., Cull, R., Qian, J.Q., Senbet, L. and Valenzuela, P. (2014), “The African financial development and financial inclusion gaps”, *Journal of African Economies*, Vol. 23 No. 5, pp. 614-642.

- Alter, A. and Yontcheva, B. (2015), "Financial inclusion and development in the CEMAC", International Monetary Fund, Working Paper, Vol. 2015 No. 235, pp. 1-31.
- Anarfo, E.B. and Abor, J.Y. (2020), "Financial regulation and financial inclusion in Sub-Saharan Africa: does financial stability play a moderating role?", *Research in International Business and Finance*, Vol. 51, 101070.
- Anarfo, E.B., Abor, J.Y., Osei, K.A. and Gyeke-Dako, A. (2019), "Financial inclusion and financial sector development in Sub-Saharan Africa: a panel VAR approach", *International Journal of Managerial Finance*, Vol. 15 No. 4, pp. 444-463.
- Bayar, Y., Ozkaya, M.H., Herta, L. and Gavriltea, M.D. (2021), "Financial development, financial inclusion and primary energy use: evidence from the European union transition economies", *Energies*, Vol. 14 No. 12, p. 3638.
- Cabeza-García, L., Del Brio, E.B. and Oscanoa-Victorio, M.L. (2019), "Female financial inclusion and its impacts on inclusive economic development", *Women's Studies International Forum*, Pergamon, Vol. 77, 102300.
- Cicchello, A.F., Kazemikhasragh, A., Monferrá, S. and Girón, A. (2021), "Financial inclusion and development in the least developed countries in Asia and Africa", *Journal of Innovation and Entrepreneurship*, Vol. 10 No. 1, pp. 1-13.
- Cull, R., Demirguc-Kunt, A. and Morduch, J. (Eds), (2021), in *Banking the World: Empirical Foundations of Financial Inclusion*, MIT Press.
- Dabla-Norris, E., Ji, Y., Townsend, R.M. and Unsal, D.F. (2021), "Distinguishing constraints on financial inclusion and their impact on GDP, TFP, and the distribution of income", *Journal of Monetary Economics*, Vol. 117, pp. 1-18.
- Dakhliá, S., Diallo, B. and Temimi, A. (2021), "Financial inclusion and ethnic development: evidence from satellite light density at night", *Journal of Behavioral and Experimental Finance*, Vol. 29, 100455.
- Grohmann, A., Klühs, T. and Menkhoff, L. (2018), "Does financial literacy improve financial inclusion? Cross country evidence", *World Development*, Vol. 111, pp. 84-96.
- Huang, Y. and Zhang, Y. (2020), "Financial inclusion and urban-rural income inequality: long-run and short-run relationships", *Emerging Markets Finance and Trade*, Vol. 56 No. 2, pp. 457-471.
- Huang, R., Kale, S., Paramati, S.R. and Taghizadeh-Hesary, F. (2021), "The nexus between financial inclusion and economic development: comparison of old and new EU member countries", *Economic Analysis and Policy*, Vol. 69, pp. 1-15.
- Kandpal, V. (2020), "Reaching sustainable development goals: bringing financial inclusion to reality in India", *Journal of Public Affairs*, Vol. 20 No. 4, p. e2277.
- Kim, D.W., Yu, J.S. and Hassan, M.K. (2018), "Financial inclusion and economic growth in OIC countries", *Research in International Business and Finance*, Vol. 43, pp. 1-14.
- Koomson, I., Villano, R.A. and Hadley, D. (2020), "Effect of financial inclusion on poverty and vulnerability to poverty: evidence using a multidimensional measure of financial inclusion", *Social Indicators Research*, Vol. 149 No. 2, pp. 613-639.
- Lenka, S.K. (2021), "Relationship between financial inclusion and financial development in India: is there any link?", *Journal of Public Affairs*, e2722. doi: [10.1002/pa.2722](https://doi.org/10.1002/pa.2722).
- Liu, Y., Luan, L., Wu, W., Zhang, Z. and Hsu, Y. (2021), "Can digital financial inclusion promote China's economic growth?", *International Review of Financial Analysis*, 101889.
- Matekenya, W., Moyo, C. and Jeke, L. (2021), "Financial inclusion and human development: evidence from sub-saharan Africa", *Development Southern Africa*, Vol. 38 No. 5, pp. 683-700.
- Neaime, S. and Gaysset, I. (2018), "Financial inclusion and stability in MENA: evidence from poverty and inequality", *Finance Research Letters*, Vol. 24, pp. 230-237.
- Ozili, P.K. (2018), "Impact of digital finance on financial inclusion and stability", *Borsa Istanbul Review*, Vol. 18 No. 4, pp. 329-340.

- Ozili, P.K. (2021a), "Financial inclusion-exclusion paradox: how banked adults become unbanked again", *Financial Internet Quarterly*, Vol. 17 No. 2, pp. 44-50.
- Ozili, P.K. (2021b), "Has financial inclusion made the financial sector riskier?", *Journal of Financial Regulation and Compliance*, Vol. 29 No. 3, pp. 237-255.
- Ozili, P.K. (2021c), "Financial inclusion in Nigeria: determinants, challenges, and achievements", *New Challenges for Future Sustainability and Wellbeing*, Emerald Publishing.
- Ozili, P.K. (2021d), "Financial inclusion research around the world: a review", *Forum for Social Economics*, Vol. 50 No. 4, pp. 457-479.
- Ozili, P.K. (2022), "Does economic policy uncertainty reduce financial inclusion?", *International Journal of Banking and Finance*, Vol. 17 No. 2, pp. 53-80.
- Rees, W.E. (1989), *Defining Sustainable Development*, University of British Columbia, Centre for Human Settlements, Vancouver, BC.
- Rumbogo, T., McCann, P., Hermes, N. and Venhorst, V. (2021), "Financial inclusion and inclusive development in Indonesia", *Challenges of Governance*, Springer, Cham, pp. 161-181.
- Vo, D.H., Nguyen, N.T. and Van, L.T.H. (2021), "Financial inclusion and stability in the Asian region using bank-level data", *Borsa Istanbul Review*, Vol. 21 No. 1, pp. 36-43.
- Zaidi, S.A.H., Hussain, M. and Zaman, Q.U. (2021), "Dynamic linkages between financial inclusion and carbon emissions: evidence from selected OECD countries", *Resources, Environment and Sustainability*, Vol. 4, 100022.

Corresponding author

Peterson K. Ozili can be contacted at: peterkitakogelu@yahoo.com