Financial inclusion and sustainable development: an empirical association

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Abstract

This paper investigates the association between financial inclusion and sustainable development in a global context. The findings show that high levels of financial inclusion (in terms of higher commercial bank branches per 100,000 adults) is significantly associated with high levels of sustainable development (in terms of 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 uni-directional granger causality between global interest in sustainable development information and global interest in financial inclusion information particularly in the period after the global financial crisis (GFC) but before the COVID-19 pandemic. The results support global calls for greater financial inclusion and the attainment of the sustainable development goals for the good of all people, the environment and for the planet.

Keywords: financial inclusion, sustainable development goals, access to finance, energy, renewables, adult literacy, industry, electricity, access to finance, unbanked adults, environment, research and development.

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1. Introduction

This paper 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. Financial inclusion and sustainable development 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 financial inclusion and sustainable development.

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; Ozili, 2021d). Existing research show 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 about the link between financial inclusion and sustainable development are important and should be encouraged among academics, practitioners and policy makers.

Using data from the World Development Indicators and data from Google Trends database, the findings show that there is uni-directional granger causality between global interest in sustainable development information and global interest in financial inclusion information 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 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 also 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

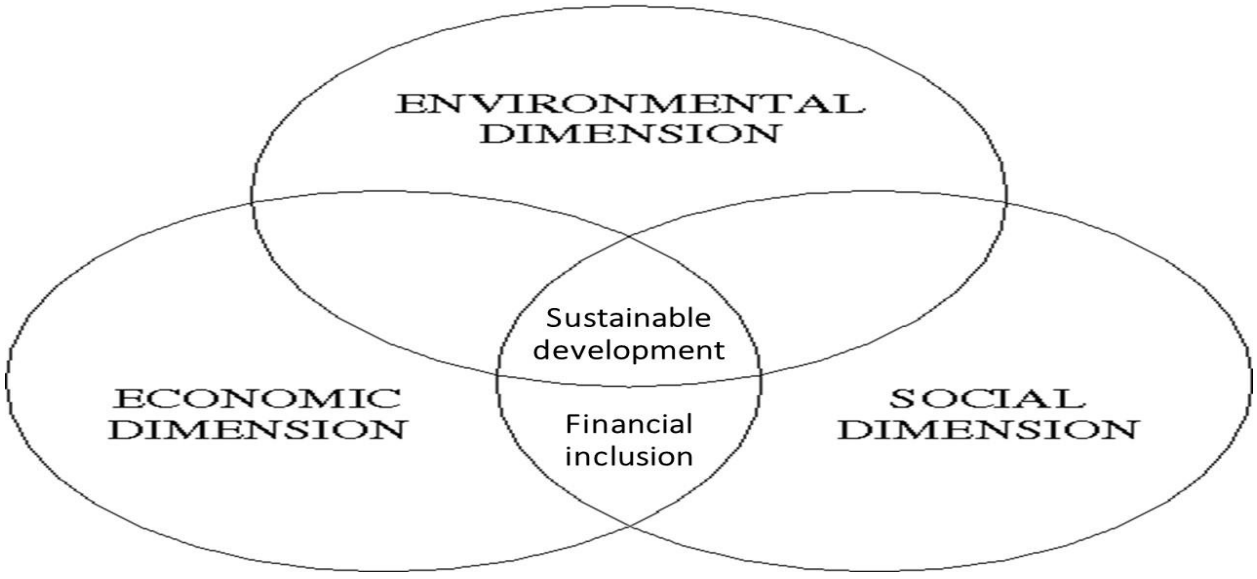
related to financial inclusion because providers of formal financial services, such as financial institutions, can reach out to unbanked adults in the community, bring them to the formal financial sector through account ownership schemes, provide affordable financial services to them, and offer them a variety of services that will improve their economic participation in society. This will not only improve the welfare of banked adults, it will also 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 discrimination 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 systems. Financial inclusion and sustainable development are interconnected when financial inclusion policies are implemented through financial institutions that operate within existing economic and social systems that are essential for sustainable development. Examples of financial inclusion policy actions that could be attributed to the economic dimension of sustainable development include (i) the issuance of new licenses to micro finance institutions to do business in remote areas in an effort to reach unbanked adults, and (ii) 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 (i) regulatory interventions to lower the high cost of banking services, and (ii) 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.

Figure 1: Linking financial inclusion to sustainable development



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 show 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). 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) and economic policy uncertainty (Ozili, 2022).

Some studies examine financial inclusion along several dimensions of development. For instance, Bayar et al (2021) analyze how the use of primary energy is affected by financial sector development and access to finance. They analyse a sample of European Union 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. Dakhlia et al (2021) examine the link between financial inclusion and ethnic development. They use a meso-level perspective, and analyse 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 programmes 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 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 OECD countries from 2004 to 2017. The results indicate a positive association 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 wellbeing 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 European Union (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 reduce income shock, and therefore, improve human development. They conduct a panel generalised method of moments regression analysis, and find that financial inclusion has a positive effect on human development. Cicchiello 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 low literacy rates are among the factors contributing to low 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 Sub-Saharan Africa. They find a reverse causality between financial sector development and financial inclusion in Sub-Saharan Africa 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 square (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 a 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 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 measures global interest over time in financial inclusion and sustainable development. Data was collected for two variables namely the 'global interest in internet information about financial inclusion (FIN)' and 'global interest in internet information about sustainable development (SD)'. During data collection, the keywords 'sustainable development' and 'financial inclusion' were inserted into the Google Trends database. The resulting data are what I refer to as 'global interest in internet information about sustainable development (SD)' and 'global interest in internet information about financial inclusion (FIN)'.

4.2. Model

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

Financial inclusion = f (sustainable development)

Sustainable development = f (financial inclusion)

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

Table 1. Variable description and source

Indicators	Meaning	Indicator	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

5. Empirical results

5.1. Correlation of financial inclusion with the sustainable development indicators

The correlation result is reported in table 2. The financial inclusion variable, CBB, is positive and significantly 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 negative and significantly 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 results suggest that financial inclusion is positive and significantly correlated with some indicators of sustainable development and is also negative and significantly correlated with other indicators of sustainable development. This suggests that the significance of the correlation or association between financial inclusion and sustainable development depends on the indicators employed to measure financial inclusion and sustainable development.

Table 2. Pearson Correlation Matrix

Variables	CBB	CRW	ELC	IND	LIT	RNW	RNT	RDE	COE	COG
CBB	1.000									

CRW	-0.869***	1.000								
	(-5.26)	-----								
	((0.00))	-----								
ELC	0.788***	-0.940***	1.000							
	(3.84)	(-8.30)	-----							
	((0.00))	((0.00))	-----							
IND	0.660**	-0.604**	0.361	1.000						
	(2.64)	(-2.27)	(1.16)	-----						
	((0.02))	((0.05))	((0.27))	-----						
LIT	0.789***	-0.958***	0.982***	0.392	1.000					
	(3.85)	(-10.13)	(15.82)	(1.28)	-----					
	((0.00))	((0.00))	((0.00))	((0.23))	-----					
RNW	0.741***	-0.901***	0.993***	0.285	0.969***	1.000				
	(3.31)	(-6.25)	(26.22)	(0.89)	(11.95)	-----				
	((0.01))	((0.00))	((0.00))	((0.39))	((0.00))	-----				
RNT	0.403	-0.567**	0.782***	-0.231	0.772***	0.833***	1.000			
	(1.32)	(-2.06)	(3.76)	(-0.71)	(3.64)	(4.52)	-----			
	((0.22))	((0.06))	((0.00))	((0.49))	((0.00))	((0.00))	-----			
RDE	0.402	-0.611**	0.708***	-0.042	0.751***	0.746***	0.818***	1.000		
	(1.32)	(-2.31)	(3.01)	(-0.12)	(3.41)	(3.36)	(4.26)	-----		
	(0.22))	((0.04))	((0.01))	((0.90))	((0.01))	((0.01))	((0.00))	-----		
COE	0.817***	-0.905***	0.801***	0.733***	0.809***	0.748***	0.339	0.325	1.000	
	(4.26)	(-6.41)	(4.01)	(3.23)	(4.13)	(3.38)	(1.08)	(1.03)	-----	
	((0.00))	((0.00))	((0.00))	((0.01))	((0.00))	((0.01))	((0.31))	((0.32))	-----	
COG	0.136	-0.482	0.545*	-0.00	0.587**	0.567*	0.563**	0.69***	0.165	1.000
	(0.41)	(-1.65)	(1.95)	(-0.00)	(2.17)	(2.07)	(2.04)	(2.87)	(0.50)	-----
	((0.68))	((0.13))	((0.08))	((0.99))	((0.05))	((0.07))	((0.07))	((0.00))	((0.62))	-----

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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 sustainable development (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 global financial crisis and during the period after the global financial crisis 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.

Table 3. Augmented Dickey-Fuller (ADF) Unit Root Test

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

Schwarz Information Criterion (SIC) is applied. Maximum 5 lags. Test for unit root in level. FIN = global interest in web search information about financial inclusion. FIN = global interest in web search information about sustainable development.

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 global financial crisis (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 global financial crisis but before the COVID-19 pandemic. This implies that there is one-way causality between global interest in internet information about the sustainable development and global interest in internet information about financial inclusion. However, 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 global financial crisis 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 global financial crisis (in table 5), during the global financial crisis (in table 6) and during the COVID-19 pandemic in table 7.

Table 4. Granger Causality (After the GFC but before COVID-19 pandemic)

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

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Table 5. Granger Causality (Period before the global financial crisis)

Pairwise Granger Causality Tests
Period: Jan 2004 – Nov 2007
Lags: 2

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

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Table 6. Granger Causality (During the global financial crisis)

Pairwise Granger Causality Tests
Sample: Dec 2007 – Jun 2009
Lags: 2

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

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Table 7. Granger Causality (During COVID-19 pandemic)

Pairwise Granger Causality Tests
Period: Jan 2020 – Dec 2021
Lags: 2

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

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5.3. Correlation of interest in financial inclusion and sustainable development information

The correlation result is reported in table 8, 9, 10 and 11. Table 8 shows that global interest in internet information about financial inclusion is negative and significantly correlated with global interest in internet information about sustainable development in the period before the global financial crisis. 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 global financial crisis. Table 10 shows that global interest in internet information about financial inclusion is positive and significantly correlated with global interest in internet information about sustainable development in the period after the global financial crisis 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 global financial crisis. Overall, the correlation results suggest that greater global interest in internet information about financial inclusion is associated with reduced global interest in internet information before the global financial crisis while greater global interest in internet information about financial inclusion is associated with greater global interest in internet information in the period after the global financial crisis but before the COVID-19 pandemic.

Table 8. Correlation analysis: Before the global financial crisis

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

t-statistic is reported in single parenthesis. P-value is reported in double parenthesis. *** denotes statistical significance at 1%.

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Table 9. Correlation analysis: During the global financial crisis (GFC)

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

t-statistic is reported in single parenthesis. P-value is reported in double parenthesis.

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

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

t-statistic is reported in single parenthesis. P-value is reported in double parenthesis. *** denotes statistical significance at 1%.

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

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

t-statistic is reported in single parenthesis. P-value is reported in double parenthesis.

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 trend 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 high levels of sustainable development in terms of 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 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.

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 used to measure financial inclusion and sustainable development. The results also show that greater interest in internet information about sustainable development 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. Policy makers should use policy tools and private sector partnership to increase the level of financial inclusion and increase efforts to achieve the sustainable development goals. The results also support 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 the 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.

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