Financial inclusion and environmental sustainability

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Abstract

This paper analyses the association between financial inclusion and environmental sustainability. The study uses Pearson correlation analysis to analyse the association between financial inclusion and environmental sustainability. The level of financial inclusion was measured using two supply-side financial inclusion indicators: the number of ATMs per 100,000 adults and the number of commercial bank branches per 100,000 adults. Environmental sustainability was measured using two indicators: the environmental policy stringency index and the environmentally adjusted multifactor productivity growth index. The study finds that financial inclusion is positively correlated with environmental sustainability particularly in non-EU countries. The result implies that financial inclusion programs and efforts in non-EU countries complement environmental sustainability efforts toward achieving the United Nations sustainable development goals (SDGs). The findings also reveal a significant and negative association between environmental policy stringency and environmentally adjusted multifactor productivity growth particularly in EU member-countries and European countries, implying that strict environmental protection policies may harm green growth in EU and European countries.

Keywords: Environment, sustainability, sustainable development, financial inclusion, access to finance, supply-side financial inclusion

JEL code: E58, G21, G18, D11, O11, O16, G00, N20.

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1. Introduction

In this paper, I examine the association between financial inclusion and environmental sustainability. I predict that financial inclusion programs and efforts can complement certain environmental sustainability efforts toward achieving the United Nations sustainable development goals (SDGs). This is because financial inclusion strategies can be designed in ways that ensure that formal financial services are accessible to all members of society while at the same time ensuring that users of formal financial services use formal financial services in ways that promote the continuity of society and the preservation of the environment. To test the validity of this argument, I empirically examine whether there is a direct association or correlation between financial inclusion and environmental sustainability using several indicators of financial inclusion and environmental sustainability.

Previous research on financial inclusion and sustainability suggest that financial inclusion can contribute to sustainable development. For example, Le et al (2019) examine the impact of financial inclusion on financial efficiency and financial sustainability in Asia. They find that high levels of financial inclusion have a positive impact on financial sustainability. Arner et al (2020) show that the presence of infrastructure to support the digital financial transformation of Fintech is vital to achieve the SDGs. Machdar (2020) analyzes the effect of financial inclusion on sustainable economic growth, and shows that financial inclusion does not affect sustainable economic growth in banks in Indonesia. These studies did not examine the association or correlation between financial inclusion efforts and environmental sustainability efforts toward achieving the sustainable development goals.

Using data for 27 OECD countries from 2004 to 2012, and focusing on some financial inclusion and environmental sustainability indicators, the main findings suggest that financial inclusion is positively associated with environmental sustainability and the association is stronger in non-EU countries.

This study contributes to the literature in the following ways. First, it contributes to the sustainable development literature (e.g. Kartick, 2012; Ozilli 2021b; Arner et al, 2020; Ozili, 2020b). It contributes to this literature by showing how financial inclusion efforts and

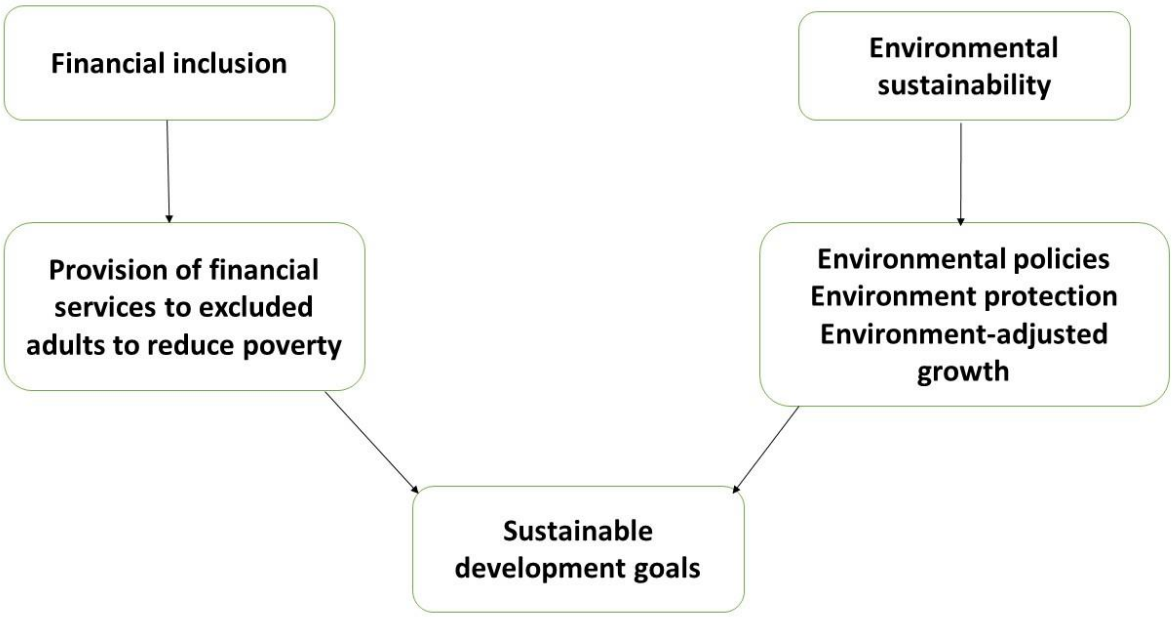
environmental sustainability efforts complement each other. Second, this study contributes to the financial inclusion literature (e.g. Datta and Singh, 2019; Ozili, 2020a; De Matteis, 2015; Ozili, 2018; Didenko et al, 2020; Ozili, 2021a). It contributes to this literature by showing that financial access indicators, such as the availability of ATM facilities and commercial bank branch networks, have a positive complementary effect for achieving sustainable development. Three, this study contributes to the environmental sustainability literature. It contributes to this literature by establishing a correlation between environmental policies and financial sector development.

The rest of the paper is structured as follows. Section 2 presents the conceptual framework. Section 3 presents the literature review. Section 4 presents the research design and the descriptive statistics. Section 5 discuss the empirical results. Section 6 concludes.

2. Conceptual framework

Financial inclusion and environmental sustainability are two concepts that have been widely linked to sustainable development (Yin et al, 2019; Klapper et al, 2016). Financial inclusion and environmental sustainability can help to achieve the sustainable development goals (SDGs) from two different pathways. Specifically, the financial inclusion agenda contributes to sustainable development by reducing global poverty levels through the provision of affordable financial services to the excluded population (Chibba, 2009; Park and Mercado, 2018), while the environmental sustainability agenda contributes to sustainable development by reducing climate change through environmental protection policies (Haque and Ntim, 2018; Yuan and Zhang, 2020). Strict environmental policies and environment-adjusted growth can ensure that economic growth is achieved without sacrificing the environment. This suggests that there is some complementarity between financial inclusion and environmental sustainability as they both contribute to achieving the SGDs even though they do so from two different dimensions – one from a financial services dimension and the other from an environmental protection dimension. Figure 1 below illustrates the complementarity between the two concepts.

Figure 1. Linking financial inclusion and environmental sustainability to sustainable development



Source: Author

3. Literature review

3.1. Financial inclusion

Voica (2017) argues that financial inclusion is an important tool to promote sustainable development because innovation in financial services such as microfinance can help to uplift people out of poverty. Kartick (2012) argues that inclusive growth cannot be achieved without high levels of financial inclusion. Yin et al (2019) show that economic policies, such as monetary policy, have a short-term positive impact on financial inclusion indicators, which implies that expansionary monetary policy can improve the level of financial inclusion in the short term.

In the United Kingdom, Rahim et al (2009) find that the vast majority of new migrants in the UK have low incomes and are more vulnerable to financial exclusion because they face difficulties in accessing and using financial services, and these difficulties are caused by both their legal status, as well as supply-side and demand-side factors (Rahim et al, 2009). They stress that, to remove these barriers, banks should engage new migrants by using outreach programs and tailoring their financial services to meet the needs of new migrants (Rahim et al, 2009). Also, banks should produce multi-language marketing materials, recruit multilingual staff, and reduce the unnecessary identification requirements (Rahim et al, 2009). Also, Lewis and Lindley (2015) show that new forms of financial exclusion are emerging as digital technology advances and risk profiling become increasingly sophisticated in the United Kingdom. Self-employed people face high levels of unsecured debt and are less likely to have pension savings (Lewis and Lindley, 2015). Financial capability is also low among the UK population, and most often, the groups with the lowest financial capability are also at most risk of financial exclusion (Lewis and Lindley, 2015). They recommend that policy makers should provide coordination for financial inclusion policies, provide support for teaching financial education in schools, provide more progressive savings incentives, encourage banks to offer basic banking services to meet the needs of the most vulnerable, and streamline government support for small businesses (Lewis and Lindley, 2015).

In Germany, Neuberger (2015) shows that the quality of financial inclusion is impaired by a low level of financial literacy, and most vulnerable individuals and small enterprises in Germany tend to be excluded or credit constrained (Neuberger, 2015). Also, programs involving microfinance

institutions have been stopped (Neuberger, 2015). They argue that the authorities should implement the right to a basic bank account with an overdraft facility, establish public credit bureaus, redirect banking regulation to protect borrowers in long-term credit relationships, strengthen financial education and entrepreneurship education in schools, and develop venture capital markets (Neuberger, 2015).

In the EU, De Matteis (2015) points out that migrants residing in the EU are deeply affected by economic crisis and they are exposed to social and financial exclusion. De Matteis show that community development schemes such as the 'self-funded communities model' can increase the level of financial inclusion for migrants residing in the EU.

In terms of financial inclusion indicators, the number of commercial bank branches per 100,000 adults and the number of ATMs per 100,000 adults are widely considered to be measures of supply-side financial access, leading to greater financial inclusion. For example, the financial inclusion index developed by Lenka and Bairwa (2016) was derived from a combination of several variables including the number of bank branches per 100,000 adults and the number of ATMs per 100,000 adults. In their analysis, they find that financial inclusion is negatively related to the inflation rate, which suggest that high levels of financial inclusion lowers the level of inflation. Also, Didenko et al (2020) show that an increase in the number of ATMs per 100,000 adults lead to a significant increase in the social safety index, which suggest that people feel safer when they have better access to ATM facilities to withdraw money whenever they need money.

3.2. Environmental sustainability

Johnstone et al (2012) investigate the impact of public environmental policy on environment-related technology innovation. They examine 77 countries between 2001 and 2007 and find that environmental policy has a positive impact on environment-related technology innovation. Similarly, Morales-Lage et al (2016) investigate the impact of environmental policy stringency on innovation and productivity in 14 OECD countries. They find that more stringent environmental regulations have a positive influence on research and development (R&D) expenditure, the number of patent applications and total factor productivity.

Albrizio et al (2014) show that the tightening of environmental policies has a positive effect on productivity growth at the firm level in technologically advanced OECD countries. Meanwhile, Ahmed and Ahmed (2018) examine the effect of environmental policy stringency on economic activity in China. They find that stringent environmental policies reduce CO2 emissions and decreases the size of GDP in China. This implies that strict environmental policies have a positive effect on environmental sustainability through a reduction in CO2 emissions even though it has a negative effect on economic growth.

4. Research methodology

4.1. Data

Financial inclusion data were collected from the global financial development indicators. Environmental sustainability data were collected from the OECD statistics database. Data were extracted for 27 OECD countries from 2004 to 2012. The reason for the narrow sample period is because financial inclusion data became available only from 2004 onwards, meanwhile, sustainability data were reported much earlier. See table 1 for variables description and source.

Table 1: Variable description and source

Variable	Description	Source
EP	Environmental Policy Stringency Index	OECD statistics
EG	Environmentally adjusted multifactor productivity growth	Green Growth Indicators, OECD Statistics
CD	Number of ATMs per 100,000 adults	Global financial development indicators, World Bank database
BR	Number of commercial bank branches per 100,000 adults	Global financial development indicators, World Bank database

4.2. Method of analysis

The statistical technique used to measure the association between the financial inclusion indicators and the selected environmental sustainability indicators is the Pearson correlation test statistic. The Pearson correlation test statistic is widely used to measure the strength of the correlation or association between two variables (Gujarati and Porter, 1999; Piaw, 2013). In this study, the Pearson correlation test statistic is used to measure the strength of the linear correlation or association between the variables and their association with each other. The Pearson correlation coefficient yields a positive or negative association between two variables, and its values range between -1 and +1. (Gujarati and Porter, 1999).

4.3. Variable justification

Financial inclusion was measured using two indicators: (i) the number of commercial bank branches per 100,000 adults (BR) and (ii) the number of ATMs per 100,000 adults (CD). The number of commercial bank branches per 100,000 adults variable (BR) is commonly used in the literature to measure the level of financial inclusion (see, Neaime and Gaysset, 2018; Naumenkova et al, 2019; Raza et al, 2019). A high number of commercial bank branches per 100,000 adults in a country signifies high levels of financial inclusion in the country as it gives people easy access to a commercial bank (Neaime and Gaysset, 2018; Taddese Bekele and Abebaw Degu, 2021). The number of ATMs per 100,000 adults variable (CD) is also a widely used indicator of financial inclusion in the literature (Van and Linh, 2019; Van et al, 2021). A high number of ATMs per 100,000 adults in a country signifies high a level of financial inclusion in the country as it gives people easy access to money in their deposit account, and this is supported by Datta and Singh (2019), Le et al (2019), Van and Linh (2019) and Van et al (2021).

Environmental sustainability is measured using two indicators: (i) the environmental policy stringency index (EP), and (ii) the environmentally adjusted multifactor productivity growth (EG). The environmental policy stringency index (EP) is a widely used indicator of environmental sustainability in the literature (see Galeotti et al, 2020); Martínez-Zarzoso et al, 2019). It measures the degree to which environmental policies put an explicit or implicit price on pollution or environmentally harmful behavior. A high environmental policy stringency index in a country

indicates the strictness of environmental rules that are put in place to preserve the environment for greater sustainable development for this generation and future generations. The environmentally adjusted multifactor productivity growth (EG) index is a widely used indicator of environmental sustainability in the literature (see Gu et al, 2019; Tolliver et al, 2021). EG is used as a proxy for sustainability because it is a green growth headline indicator, and because it measures a country's ability to generate income from a given set of inputs while accounting for the consumption of natural resources and production of undesirable environmental outputs (Rodríguez et al, 2018). A high EG index in a country indicates higher green growth toward environmental sustainability.

4.4. Descriptive statistics

The descriptive statistic is reported in table 2. The environmental policy stringency index (EP) on average is 2.57 and EP is highest in Denmark and lowest in Turkey. Denmark records the highest average EP and is a EU country while Turkey has the lowest EP average and is a non-EU country. This suggests that environmental policies are stronger in EU countries compared to non-EU countries. Also, the environmentally adjusted multifactor productivity growth (EG) is 1.26 on average and EG is highest in Korea and lowest in Greece. Korea records the highest average EG and is a non-EU country while Greece has the lowest EG average and is a EU country. This suggests that green growth is higher in non-EU countries such as in Korea. The number of ATMs per 100,000 adults (CD) on average is 99.44 and CD is highest in Korea, and lowest in Czech Republic. This suggests that financial inclusion (through ATMs penetration) is higher in countries outside the EU. The number of bank branches per 100,000 adults (BR) BR is 33.52 on average and BR is highest in Spain and lowest in Norway. This suggests that commercial bank branch penetration is high in EU countries.

Table 2. Summary of Descriptive statistics

S/N	Countries	EP	EG	CD	BR	Region
1	Australia	2.36	1.17	156.86	31.01	Non-EU
2	Austria	2.90	1.45	111.63	13.32	EU, Europe
3	Belgium	2.39	1.13	87.95	49.42	EU, Europe
4	Canada	2.91	1.04	207.21	24.36	Non-EU, G7
5	Czech Republic	2.48	1.83	39.01	22.34	EU, Europe
6	Denmark	3.40	0.81	65.80	45.84	EU, Europe
7	Finland	3.04	1.04	53.20	15.09	EU, Europe
8	France	3.11	1.15	100.02	38.06	EU, Europe, G7
9	Germany	2.91	1.43	114.25	16.93	EU, Europe, G7
10	Greece	2.00	-1.31	75.20	39.04	EU, Europe
11	Hungary	2.57	0.87	50.68	16.33	EU, Europe
12	Ireland	2.02	4.89	90.37	31.51	EU, Europe
13	Italy	2.5	0.57	91.51	58.33	EU, Europe, G7
14	Japan	2.08	1.08	127.01	34.03	Non-EU, G7
15	Korea	3.07	2.37	244.09	17.98	Non-EU
16	Netherlands	3.14	0.83	59.45	26.08	EU, Europe
17	Norway	2.51	1.11	57.43	11.54	EU, Europe
18	Poland	2.38	1.80	41.43	30.55	EU, Europe
19	Portugal	2.38	0.51	176.31	65.29	EU, Europe
20	Slovakia	2.03	1.98	47.82	26.25	EU, Europe
21	Slovenia	2.12	1.67	95.64	39.51	EU, Europe
22	Spain	2.76	0.87	149.32	97.02	EU, Europe
23	Sweden	2.98	1.07	40.94	23.04	EU, Europe
24	Switzerland	2.67	1.37	93.80	53.61	Non-EU, Europe
25	Turkey	1.53	0.89	43.71	16.19	Non-EU, Europe
26	United Kingdom	2.61	1.16	122.82	25.83	EU, Europe, G7
27	United States	2.26	1.31	169.67	34.56	Non-EU, G7
	Full sample:					
	Mean	2.57	1.26	99.44	33.52	
	Median	2.60	1.45	90.29	28.65	
	Maximum	4.13	14.25	288.47	104.21	
	Minimum	0.83	-7.01	25.44	9.92	
	Std. Dev	0.65	2.34	54.81	19.02	
	Observation	239	242	235	241	

5. Results

5.1. Pearson Correlation results: full sample

The full sample Pearson correlation result is reported in table 3. Only the significant correlation coefficient results are interpreted. The two environmental sustainability indicators (EP and EG) are significant and negatively correlated at -0.18***. This indicates that high environmental policy stringency is associated with lower environmentally adjusted multifactor productivity growth. This implies that strict environmental protection policies may harm green growth.

Also, the two financial inclusion indicators (BR and CD) are significant and positively correlated at 0.24***. This suggests that a higher number of ATMs per 100,000 adults is associated with a larger number of commercial bank branches per 100,000 adults, which jointly have positive effects for financial inclusion.

Interestingly, the EP and CD correlation coefficient (0.158***) is significant and positively correlated. This indicates that higher environmental policy stringency is associated with greater financial inclusion through higher number of ATMs per 100,000 adults. This implies that environmental sustainability is positively associated (or correlated) with financial inclusion.

On the other hand, the CD and EG coefficient (0.002), BR and EG coefficient (-0.091), and BR and EP coefficient (-0.013) are all statistically insignificant. Therefore, no meaningful conclusion can be drawn for these correlations.

Table 3: Pearson correlation statistic (All countries)

Variable	EP	EG	CD	BR
EP	1.000			

EG	-0.185***	1.000		
	(-2.83)	-----		
	((0.005))	-----		
CD	0.158**	0.002	1.000	
	(2.41)	(0.02)	-----	
	((0.016))	((0.980))	-----	
BR	-0.013	-0.091	0.241***	1.000
	(-0.19)	(-1.38)	(3.74)	-----
	((0.842))	((0.167))	((0.000))	-----

EP = Environmental Policy Stringency index. EG = Environmentally adjusted multifactor productivity growth index. CD = number of ATMs per 100,000 adults. BR = number of commercial bank branches per 100,000 adults. T-statistic is reported in single parenthesis. P-value is reported in double parenthesis. *** and ** denotes statistical significance at the 1% and 5% levels. The countries in the full sample category are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and the United States.

5.2. Subsample analysis

In this section, I analyse the correlation between financial inclusion and environmental sustainability for the European countries, the European Union (EU) member-counties, the non-EU countries and the G7 countries in sample.

5.2.1. Correlation: European countries only

In this section, I analyse the correlation for the European countries in the sample. The European countries category correlation result is reported in table 4. Only the significant correlation coefficient results are interpreted. The two environmental sustainability indicators (EP and EG) are also significant and negatively correlated at -0.22***, which indicates that high environmental policy stringency is associated with lower environmentally adjusted multifactor productivity growth in European countries. This implies that strict environmental protection policies may harm green growth in European countries.

Also, the two financial inclusion indicators (BR and CD) are also significant and positively correlated at 0.61***. This suggests that a higher number of ATMs per 100,000 adults is associated with a larger number of commercial bank branches per 100,000 adults, which jointly have positive effects for financial inclusion in European countries.

On the other hand, the CD and EP coefficient (0.107), CD and EG coefficient (-0.057), BR and EG coefficient (-0.081), and the BR and EP coefficient (0.029) are all statistically insignificant. Therefore, no meaningful conclusion can be drawn for these correlations.

Table 4: Pearson correlation analysis (European countries category)

Variable	EP	EG	CD	BR
EP	1.000			

EG	-0.221***	1.000		
	(-3.10)	-----		
	((0.002))	-----		
CD	0.107	-0.057	1.000	
	(1.47)	(-0.78)	-----	
	((0.142))	((0.431))	-----	
BR	0.029	-0.081	0.613***	1.000
	(0.39)	(-1.10)	(10.58)	-----
	((0.693))	((0.270))	((0.000))	-----

EP = Environmental Policy Stringency index. EG = Environmentally adjusted multifactor productivity growth index. CD = the number of ATMs per 100,000 adults. BR = the number of commercial bank branches per 100,000 adults. T-statistic is reported in single parenthesis. P-value is reported in double parenthesis. *** denotes statistical significance at the 1% level. There are 22 countries in the Europe category, namely: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

5.2.2. Correlation: EU countries only

Not all countries in Europe are member-countries of the European Union (EU). In this section, I analyse the correlation for the European Union (EU) member-counties in the sample.

The EU countries correlation result is reported in table 5. Only the significant correlation coefficient results are interpreted. The two sustainability indicators (EP and EG) are significant and negatively correlated at -0.255***. This indicates that high environmental policy stringency is associated with lower environmentally adjusted multifactor productivity growth in EU member-countries. This implies that strict environmental protection policies may harm green growth in EU member-countries.

Also, the two financial inclusion indicators (BR and CD) are significant and positively correlated at 0.596***. This suggests that a higher number of ATMs per 100,000 adults is associated with higher number of commercial bank branches per 100,000 adults, which jointly have positive effects for financial inclusion in EU member-countries.

On the other hand, the CD and EP coefficient (0.009), CD and EG coefficient (-0.065), BR and EG coefficient (-0.097), and the BR and EP coefficient (-0.054) are all statistically insignificant. Therefore, no meaningful conclusion can be drawn for these correlations.

Table 5: Pearson correlation analysis (European Union (EU) countries category)

Variable	EP	EG	CD	BR
EP	1.000			

EG	-0.255***	1.000		
	(-3.42)	-----		
	((0.001))	-----		
CD	0.009	-0.065	1.000	
	(0.12)	(-0.84)	-----	
	((0.901))	((0.402))	-----	
BR	-0.054	-0.097	0.596***	1.000
	(-0.69)	(-1.27)	(9.63)	-----
	((0.485))	((0.204))	((0.000))	-----

EP = Environmental Policy Stringency index. EG = Environmentally adjusted multifactor productivity growth. CD = the number of ATMs per 100,000 adults. BR = the number of commercial bank branches per 100,000 adults. T-statistics are reported in single parenthesis. P-values are reported in double parenthesis. *** denotes statistical significance at the 1% level. There are 20 countries in the EU category: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom

5.2.3. Correlation: non-EU countries only

I also analyse the correlation for the countries that are outside the European Union in the sample. The non-EU countries correlation result is reported in table 6. Only the significant correlation coefficient results are interpreted. Also, the two financial inclusion indicators (BR and CD) are weakly significant and negatively correlated at 0.243***. This suggests that a higher number of ATMs per 100,000 adults is associated with a fewer number of commercial bank branches per 100,000 adults in non-EU countries.

Interestingly, the EP and CD correlation coefficient (0.585***) is significant and positively correlated. This indicates that higher environmental policy stringency is associated with greater financial inclusion through higher number of ATMs per 100,000 adults. This implies that sustainability is positively associated (or correlated) with financial inclusion for countries outside the European Union.

On the other hand, the CD and EG coefficient (0.096), BR and EG coefficient (-0.038), and the BR and EP coefficient (0.058) are all statistically insignificant. Therefore, no meaningful conclusion can be drawn for these correlations.

Table 6: Pearson correlation analysis (non-EU countries category)

Variable	EP	EG	CD	BR
EP	1.000			

EG	-0.016	1.000		
	(-0.12)	-----		
	((0.899))	-----		
CD	0.585***	0.096	1.000	
	(5.41)	(0.72)	-----	
	((0.000))	((0.471))	-----	
BR	0.058	-0.038	-0.243*	1.000
	(0.43)	(-0.29)	(-1.88)	-----
	((0.663))	((0.772))	((0.065))	-----

EP = Environmental Policy Stringency index. EG = Environmentally adjusted multifactor productivity growth. CD = the number of ATMs per 100,000 adults. BR = the number of commercial bank branches per 100,000 adults. T-statistics are reported in single parenthesis. P-values are reported in double parenthesis. *** and * denotes statistical significance at the 1% and 10% levels. There are seven (7) countries in the non-EU category: Australia, Canada, Japan, Korea, Switzerland, Turkey and the United States.

5.2.4. Correlation: G7 countries category

In this section, I analyse the correlation for the G7 countries in the sample. The G7 countries correlation result is reported in table 7. Only the significant correlation coefficient results are interpreted. The two financial inclusion indicators (BR and CD) are significant and negatively correlated at -0.441***. This suggests that a higher number of ATMs per 100,000 adults is associated with fewer number of commercial bank branches per 100,000 adults for G7 countries. On the other hand, the EP and CD coefficient (-0.139), CD and EG coefficient (-0.033), BR and EG coefficient (-0.105), and the BR and EP coefficient (-0.139) are all statistically insignificant. Therefore, no meaningful conclusion can be drawn for these correlations.

Table 7: Pearson correlation analysis (G7 countries category)

Variable	EP	EG	CD	BR
EP	1.000			

EG	-0.178	1.000		
	(-1.31)	-----		
	((0.195))	-----		
CD	0.146	-0.033	1.000	
	(1.07)	(-0.24)	-----	
	((0.289))	((0.809))	-----	
BR	-0.139	-0.105	-0.441***	1.000
	(-1.02)	(-0.76)	(-3.54)	-----
	((0.313))	((0.449))	((0.001))	-----

EP = Environmental Policy Stringency index. EG = Environmentally adjusted multifactor productivity growth. CD = number of ATMs per 100,000 adults. BR = number of bank commercial branches per 100,000 adults. T-statistic is reported in single parenthesis. P-value is reported in double parenthesis. *** denotes statistical significance at the 1% levels. There are seven (7) countries in the G7 category: Canada, Japan, Italy, Germany, France, United Kingdom and the United States.

6. Conclusion

The paper analysed the association between financial inclusion and environmental sustainability. The two financial inclusion indicators used in the study are the number of ATMs per 100,000 adults and the number of commercial bank branches per 100,000 adults, while the two sustainability indicators used in the study are the environmental policy stringency index and the environmentally adjusted multifactor productivity growth. Pearson correlation statistic was used to test the association between the financial inclusion indicators and environmental sustainability indicators.

The main findings show that financial inclusion is positively associated with environmental sustainability particularly in non-EU countries. This means that higher environmental policy stringency, which is a sustainability indicator, is associated with higher ATMs per 100,000 adults, which is a financial inclusion indicator. The findings also reveal a significant and negative association between environmental policy stringency and environmentally adjusted multifactor productivity growth particularly among EU member-countries and European countries, implying that strict environmental protection policies may harm green growth in EU and European countries. Also, there is a significant and positive association between the number of ATMs per 100,000 adults and the number of commercial bank branches per 100,000 adults particularly in EU member-countries and European countries but not for non-EU countries. There is a significant and negative association between the number of ATMs per 100,000 adults and the number of commercial bank branches per 100,000 adults in non-EU and G7 countries.

The implication of the observed positive association between financial inclusion and environmental sustainability is that financial inclusion objectives and environmental sustainability objectives can complement each other in the drive to achieve the United Nations sustainable development goals (SDGs). The complementary benefits of financial inclusion and environmental sustainability will ensure that formal financial services are accessible to all members of society, and ensure that users of formal financial services use formal financial services in ways that promote the continuity of society and the preservation of the environment. Policy makers should find ways to strengthen existing environmental policies to preserve the

environment. Financial authorities, on the other hand, should ensure that formal financial services are delivered in ways that promote sustainable growth in society and the environment. Also, there may be a need to make changes in the national financial inclusion strategy to ensure that financial inclusion is aligned with environmental sustainability goals.

The study has some limitations. One, the sample period used in the study is limited only to a few years. Two, the study is restricted only to OECD countries. Three, the study used a narrow set of financial inclusion and environmental sustainability indicators. This was largely due to data unavailability problems. These limitations offer some fruitful areas for future research.

Future studies can re-examine the association between financial inclusion and environmental sustainability in other regional contexts such as in the MENA region and the ASEAN region. Secondly, it will be interesting to investigate the cause-and-effect relationship between financial inclusion and environmental sustainability using regression analysis and taking into account any potential endogeneity problems that may arise from such analysis. Finally, future studies can examine the association between financial inclusion and environmental sustainability using more recent data when such data becomes available.

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