

# Islamic and Conventional Financial Inclusion- Green GDP Nexus: Case of OIC Countries

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## Abstract

Our study investigates the impacts of both Islamic and conventional financial inclusion on green GDP in 19 of OIC countries using some macroeconomic factors. We evaluate the effects of ATM and bank branches of Islamic and conventional banks as a financial inclusion component, institutional quality, human capital, trade openness on green GDP from 2013 to 2021 using the Difference GMM (D-GMM) estimator. According to the study's empirical findings, institutional quality negatively correlates with green GDP. In addition, we found that bank branches of Islamic banks have a positive and significant impact on green GDP in OIC countries. Whereas, human capital significantly negatively affects green GDP. According to our research, a 1% increase in institutional quality leads to a 0.31% decrease in green GDP. Accordingly, a 1% rise in Islamic bank branches increase green GDP by 0.045%. Despite the Islamic side, the conventional financial inclusion shows no dynamic effects on green GDP. The results validate the link as a higher degree of access to Islamic financial services contributes positively to green GDP in OIC countries. Even though institutional quality proxied by control of corruption contributed negatively to green GDP, OIC governments should emphasise preserving and expanding the Islamic means of financial services to increase and promote green GDP in effort to minimize environmental degradation.

**Keywords:** Islamic Financial Inclusion, Financial Inclusion, GMM, OIC Countries.

## Introduction

Governments have made numerous efforts in many countries to achieve their development goals with the single aim of improving the welfare of the people. However, these efforts often lead to adverse outcomes such as pollution and other environmental deterioration. Although rapid economic growth is often viewed as positive, the unavoidable environmental harm it causes is a significant challenge, especially for developing countries. Economic growth is crucial to economic development Perera & Lee (2013), but it also affects environmental quality (Arouri et al., 2012; Kasman & Duman, 2015). Growth target increases carbon dioxide

(CO<sub>2</sub>) emissions, affecting environmental sustainability (Arouri et al., 2012; Muhammad, 2019).

OIC member countries are especially prone to the environmental alterations caused by increased human activity. Due to their limited resources and inability to adapt to environmental changes, low-income and underdeveloped member states are particularly vulnerable. In recent decades, the socioeconomic growth of OIC countries has been rapid and stable. However, concurrently, environmental deterioration has increased due to this development. Even when compared to rising economies, OIC countries are among the world's leading contributors to CO<sub>2</sub> emissions. OIC's greenhouse gas emissions (GHG) per capita increased over the years.

Most global warming is driven by human activities releasing greenhouse gases. The upward trend of greenhouse gas emissions persists despite economic, technical, and political efforts. Between 1990 and 2017, global greenhouse gas emissions increased by 43%, to 50 Gt-CO<sub>2</sub> equivalent. Over the same period, GHG emissions in OIC countries rose by 77% to a total of 9 Gt-CO<sub>2</sub> equivalent, accounting for 18.1% of world GHG emissions (OIC Environment Report 2021). Some member Countries in OIC region were the top emitters per capita in 2020, with Qatar having the highest GHG emissions per person (Brussels international center, 2022).

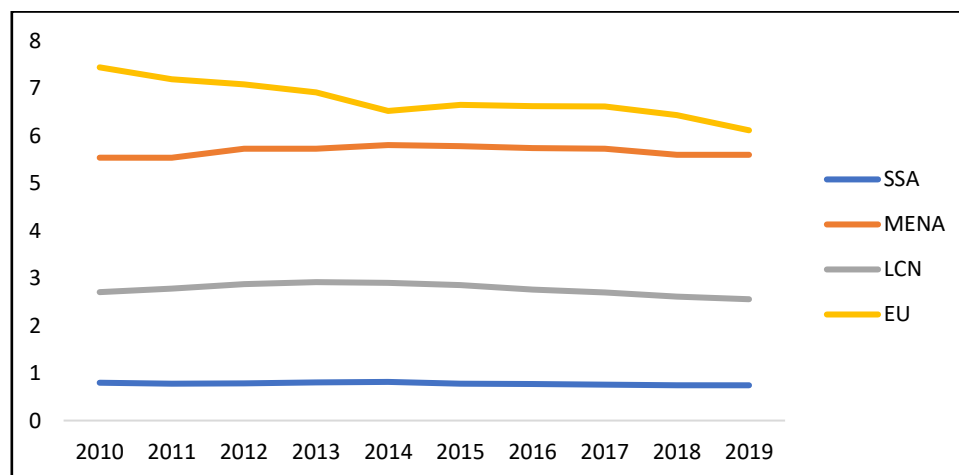


Figure 1: CO<sub>2</sub> Emissions Metric Tons Per Capita 2010-2019

Source: World Bank (2022).

Climate change causes devastating impacts like extreme weather events like flooding and deadly storms, the spread of disease, sea level rise, increased food insecurity, and other disasters. These impacts can cost businesses, families, governments, and taxpayers hundreds of billions of dollars through rising health care costs, destruction of property, increased food prices, and more. The social cost of carbon is a measure of the economic harm from those impacts, expressed as the dollar value of the total damages from emitting one ton of carbon dioxide into the atmosphere. The current central estimate of the social cost of carbon is over \$50 per ton in today's dollars. While this is the most robust and credible figure available, it does not yet include all of the widely recognized and accepted scientific and economic impacts of climate change. For that reason, many experts agree that this is far lower than the true cost of carbon pollution.

Financial inclusion can be a mitigating mechanism (Renzhi & Baek, 2020; Mirza, et al., 2021). Developing countries are battling to enhance their living standards by increasing financial inclusion levels. If financial inclusion proves to be a viable mitigation strategy, development

and climate change policies can be combined to achieve synergy (Rizvi et al., 2021; Yang et al., 2022). Generally, the financial development process attracts more research and development (R&D) and FDI, which reduces environmental damage due to economic development and expansion (Usman et al., 2021). In this regard, industrial units with access to current technology may initiate new sources of energy-efficient, smart, clean, and environmentally friendly manufacturing; as a result, a sustainable environment tends to improve (Chen, et al., 2021; Umar, et al., 2021). Furthermore, a strong and well-developed financial sector encourages businesses to invest in environmentally friendly projects and allows for low capital expenditures (Usman et al., 2021).

Financial inclusion index has been developed and constructed by previous studies as mentioned earlier. The information about how comprehensive the financial system is that is partial and incomplete. Misunderstandings about an economy's level of financial inclusion can result even from the use of individual indicators (Sarma, 2016). When attempting to find a suitable measurement to fully evaluate the scope of coverage of a financial system, numerous studies have been carried out. The financial inclusion index is the name of this measurement. If Gupte et al (2012) created the financial inclusion index to gauge the level of financial inclusion in India by averaging four crucial factors like usage, outreach, transaction ease, and cost of transactions. Also, Sarma and Pais (2011); Park and Mercado (2015) calculated financial inclusion index by combining three-dimension factors: ATMs, bank branches, borrowers, depositors and domestics credit to GDP ratio.

Green GDP is the final result of a country or region's economic activity after taking into account the impact of natural resources (mainly land, forests, minerals, water, and oceans) and environmental factors (including ecological environment, natural environment, human environment, and others). The costs of resource depletion and environmental harm incurred by economic activity lower GDP. Vaghefi et al (2015) Popular among the several formulas for determining green GDP is the following:

$$\text{Green GDP} = \text{Total GDP} - (\text{environmental resource cost} + \text{environmental resource protection service fee})$$

Since the current traditional economic systems failed to take into account the environmental crisis in the world. The concept of green GDP has emerged. Green GDP is a substitute measure of economic growth that accounts for environmental concerns alongside traditional measures of GDP. Green GDP considers the damage caused by climate change and biodiversity loss. The greatest benefit of green GDP is that it assigns a monetary value to the cost of environmental damage and modifies GDP to represent environmental expenses more accurately. The connection between the economy and the environment is highly substantial, particularly in emerging countries such as the countries of the OIC region, who are now experiencing substantial economic growth.

There are several issues related to OIC countries and green GDP topic. First, OIC countries are the most polluted countries as stated by the world air report. The report shows that the top 10 polluted countries are mostly OIC countries such as Afghanistan, Bangladesh, Bahrain and Kuwait. These countries have abundant natural resources, such as oil and gas. Second, Green GDP is a combination of GDP and environmental considerations, and the evidence indicates that finance may have an influence on economic growth via institutional quality (Law et al., 2013). In addition, finance-growth link is still inconclusive and further research that combines

finance, institutional quality on the two in one factor of growth-environment (green GDP) would significantly contribute to the nexus.

This research provides to the scholarly literature in three ways. First, this article combines Islamic and conventional financial inclusion on green growth. The second contribution of this study is the to our knowledge the only handful study that attributes to green GDP effects. Most of previous studies looked at CO2 emission and environmental degradation, however, green GDP gives both economic and environment concept to the economy.

### **Literature Review**

Theoretically, there are two types of economic growth models: the exogenous growth model and the endogenous growth model. The exogenous growth model is associated with technology, capital formation, and labor productivity, in addition to the enhancement of human capital. Many economic growth models have emphasized the latest technology, where new technology means financial technology with digitalization, ATMs, and online banking (Bal & Nijkamp, 1998).

Access to finance has been a heated topic on the international policy platform since the early 2000s. Many countries employ financial inclusion as a way to promote more evenly distributed economic expansion (Collard, 2007; Ratnawati, 2020). Financial inclusion is vital for constructing a solid foundation for the world's financial infrastructure, which will promote economic development and prosperity (Sharma, 2016).

Plentiful pieces of literature are available on the connection between inclusive finance and economic expansion in different developed and developing countries. There is limited literature in this field, and inclusive finance in developed and emerging economies is still in the infant stage (Park & Mercado, 2015; Sulong & Bakar, 2018).

However, there are still contradictory results based on the previous literature. Some researchers have found a positive association between inclusive finance and economic expansion (Babajide et al., 2015; Sharma, 2016; Thomas et al., 2017; Lenka & Barik, 2018; Kim et al., 2018; Sethi & Acharya, 2018; Ahmad et al., 2021; Emara & El-Said, 2021; Singh & Stakic, 2021; Makina & Walle, 2019; Banerjee et al., 2021; Upasana & Banajit, 2022).

A study by Upasana & Banajit (2022) considers a panel of 153 economies in three years (2011, 2014, and 2017) and employs feasible generalized least squares (FGLS) to analyze the effect of financial inclusion on economic growth. Their founding shows that all three dimensions of financial inclusion are positively related to the dependent variable, economic growth. These results indicate that when access to and use of financial products and services is greater and of better quality, economic growth will increase, enabling more opportunities for starting, operating, and expanding businesses, creating new investment avenues, and generating employment.

To assess the connection between digital inclusive finance and the province's economic development from 2011 to 2018, a study was carried out in China. The fixed-effect model demonstrated that digital inclusive finance boosted the Chinese province's economic expansion, and that the Chinese government should establish supportive systems to expand digital financial inclusion (Ahmad et al., 2021). The financial sectors in the MENA region dominate bank-based financial institutions. Emara and El-Said (2021) explored the association between inclusive finance and economic expansion for 44 emerging markets and MENA countries from 1990 to 2018. The GMM system and dynamic panel regression model were

utilized to scrutinize the yearly data. The overall findings disclosed that inclusive finance favorably affected economic growth.

Sharma (2016) investigates the nexus between the vast dimensions of financial inclusion and economic growth in India, an emerging economy, for the period 2004–2013. Three core dimensions of financial inclusion are focused on: banking penetration, availability of banking services, and use of banking services (deposits). The study finds a positive linkage between economic growth and several dimensions of financial inclusion. The empirical results based on Granger causality analysis show that there is a bidirectional causal relationship between geographic outreach and economic development as well as a unidirectional causality running from the number of deposits and loan accounts to GDP.

Additionally, Sethi & Acharya (2018), for 31 developing and developed countries for the period from 2004 to 2010, scrutinized the association between inclusive finance and economic expansion by employing the fixed, random effect, and panel co-integration on the panel dataset. The outcomes revealed the positive and significant connection and bidirectional causality between inclusive finance and economic expansion. Likewise, Kim et al (2018), for 55 OIC nations from 1990 to 2013, scrutinized the link between inclusive finance and economic expansion. Based on the outcomes, inclusive finance has a positive connection with economic expansion.

Babajide et al (2015) used annual data series from 1981 to 2012 to investigate the impact of financial inclusion on economic growth in Nigeria. The commercial bank deposit (CMBD), which reports 'the number of deposit account holders in commercial banks and other resident banks functioning as commercial banks that are resident nonfinancial corporations (public and private) and households', taken from the World Development Indicators (WDI), is used as the proxy for financial inclusion in the study. They conclude that financial inclusion is not only a result of economic growth but also its driver (Babajide et al., 2015).

By developing a multidimensional financial inclusion index, Singh & Stakic (2021) assess the long-run relationship between financial inclusion and economic growth in the South Asian Association for Regional Cooperation (SAARC) region. Singh & Stakic (2021) find that an increase in financial inclusion initiatives would have a profound impact on economic growth in SAARC countries. They also find a bidirectional causality between GDP per capita and the financial inclusion index. Similar studies by Thomas et al (2017); Lenka & Barik (2018) use different statistical techniques and variables.

In their study, Makina and Walle (2019) examined the association between financial inclusion and macroeconomic growth, specifically focusing on the dimension of access. The findings of their research revealed a significant and positive impact of financial inclusion on economic growth within the African context. Banerjee et al (2021) examine the effects of financial inclusion on development outcomes, considering four development goals: economic growth, education, health, and income inequality. They use an aggregated measure by constructing a hybrid index and a disaggregated measure by focusing on three dimensions of financial inclusion (access, usage, and quality) and find that aggregate financial inclusion has a strongly positive effect on all development outcomes, but this effect is negatively associated with political risk in a country.

Kim et al (2018) examines the linkage between financial inclusion and economic growth in Organization of Islamic Cooperation (OIC) countries. Five variables were employed to measure key factors of financial inclusion, namely: (1) automated teller machines per 100,000 adults; (2) bank branches per 100,000 adults; (3) deposit accounts with commercial banks per 1000 adults; (4) borrowers from commercial banks per 1000 adults; and (5) life insurance

premium volume to GDP. Based on the results of dynamic panel estimations performed on panel data for 55 OIC countries, the study finds that financial inclusion has a crucial role in promoting economic growth and that there are mutual causalities between the two variables. While the study provides some interesting results, there are several limitations. First, major differences exist among OIC countries, including the level of financial inclusion. These variations might be attributable to different religious levels, gender inequality, illiteracy rates, interest rates, income levels, and policies. Thus, it is necessary to consider the factors that may impact the level of financial inclusion in Islamic countries when modeling. Second, multiple financial inclusions are examined separately in different models instead of a composite index for financial inclusion.

However, very few empirical studies have shown a negative relationship between financial inclusion and financial stability (see Morgan & Pontines, 2014; Neaime & Gaysset, 2018). Regarding this, Khan (2011), for 11 MENA nations, also looked at the relationship between economic expansion and financialization. The findings indicated that financialization had a detrimental effect on economic expansion. The link between inclusive finance and economic expansion has to be further investigated in light of the contradictions in the aforementioned arguments.

More recently, Renzhi & Baek (2020) studied the connection between financial inclusion and carbon emissions for a panel of 103 nations. They used the GMM and illustrated that financial inclusion could be a better measure for mitigating carbon emissions. The same studies conducted by Usman et al (2021) analyzed financial development as a proxy for financial inclusion for the 15 highest emitting countries from 1990 to 2017. They concluded that financial inclusion overcomes environmental degradation and decreases nature's carbon emissions. Specifically in developing countries, financial inclusion is important for disadvantaged communities where farmers may lack the funds or credit needed to participate in sustainable energy technology. For instance, solar energy microgrids are not only cost-effective but also produce far fewer CO<sub>2</sub> emissions than coal-fired power plants (IPA, 2017). On the other hand, better access to financial services boosts industrial and manufacturing activity, potentially increasing CO<sub>2</sub> emissions and, as a result, increasing global warming (Le et al., 2020). Furthermore, increased financial activities may result in energy poverty, which may be a source of CO<sub>2</sub> emissions (Zhao et al., 2021). The improvement in financial inclusion allows individuals to offer high-energy consumer products such as cars, coolers, and air conditioners, which pose a serious environmental risk due to increased emissions (Tao et al., 2022). Inclusive financial systems boost economic activities, which raise the demand for non-renewable energy sources and emit more carbon emissions around the globe (Frankel & Romer, 1999). Le et al. (2020) used the Driscoll-Krstan standard errors method for 31 Asian countries to examine the dynamic associations between financial inclusion and CO<sub>2</sub> emissions from 2004–2014. Their findings found that financial inclusion, FDI, income, industrialization, urbanization, and energy consumption have a negative impact on carbon emissions. The previous mentioned literature indicates that there were no specific studies on Islamic financial inclusion and their impact on economic outcomes, such as green GDP. Hence, this study attempts to fill this gap by analyzing the Islamic financial inclusion-green GDP nexus along with conventional financial inclusion.



**Materials and Methods****Model Specification**

The goal of this paper is to examine the effect of financial development and institution on green GDP in OIC countries. Thus, the empirical model augmented from Hayat (2019) and the model for analysis is as follows:

$$\ln GGDP_{it} = \alpha + \beta_1 \ln GGDP_{i,t-1} + \beta_2 \ln IFI_{it} + \beta_3 X'_{it} + v_i + \eta_t + u_{it} \quad (1)$$

$$\ln GGDP_{it} = \alpha + \beta_1 \ln GGDP_{i,t-1} + \beta_2 \ln FI_{it} + \beta_3 X'_{it} + v_i + \eta_t + u_{it} \quad (2)$$

Where  $i$  and  $t$  are the country and time index, respectively,  $GGDP$  is green GDP.  $IQ$  It is extensively used in the literature to imply institutional quality, which is proxied by control of corruption.  $IFI$  is Islamic financial inclusion, while  $FI$  denotes conventional financial inclusion, and  $X'$  is the vector of control factors anticipated to effect green GDP,  $v_i$  is country specific effect,  $\eta_t$  is the time specific effect, and  $u_{it}$  is the error term. Consequently, the model specification includes the word democracy squared as follows:

$$\ln GGDP_{it} = \alpha + \beta_1 \ln GGDP_{i,t-1} + \beta_2 \ln IFI_{it} + \beta_3 \ln IQ_{it} + \beta_4 \ln TO_{it} + \beta_5 \ln HC_{it} + v_i + \eta_t + u_{it} \quad (3)$$

$$\ln GGDP_{it} = \alpha + \beta_1 \ln GGDP_{i,t-1} + \beta_2 \ln FI_{it} + \beta_3 \ln IQ_{it} + \beta_4 \ln TO_{it} + \beta_5 \ln HC_{it} + v_i + \eta_t + u_{it} \quad (4)$$

The general method of moments (GMM) is addressed, as proposed by Holtz-Eakin et al. (1988) and refined by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). From 2013 to 2021, the Difference GMM (D-GMM) estimator is used to a panel of 19 OIC economies for the estimation. To establish the validity of the enhanced findings, two diagnostic tests based on Arrelano and Bond (1991) are utilized to analyze the first and second order serial correlation in the errors. According to the rule of thumb, serial correlation of the first order may be ignored, while serial correlation of the second order cannot. The second test is the Sargan/Hansan test, which addresses the issue of overidentification, which is induced by a variety of instruments and would lead to an estimate that is skewed.

The system GMM estimator Blundell and Bond (1998) is utilized because it offers consistent parameter estimates and is more objective than the pooled ordinary least squares (OLS), within-groups (fixed effect), and difference GMM estimators. The system GMM can account for endogeneity because it provides more precise estimates than alternatives like the difference GMM and fixed effect models. An additional benefit of system GMM over pooled OLS and dynamic fixed effect estimations is bias, which implies that the correlation between the lagged dependent variable and the specific fixed effect may be distorted if the coefficient on the lagged dependent variable approaches zero. In models with shorter temporal dimensions, the bias has a greater impact. Bond et al (2001) report that the coefficient on the lagged dependent variable generated from pooled OLS is upwardly biased, but the within-groups estimate is downwardly biased. Before offering actual data, this study will validate the above-mentioned reasons for employing the network GMM estimator.

One-step and two-step estimators are the two variants of GMM estimators. Using optimal weighting matrices, the two-step estimator is potentially more successful than the one-step estimator. Note that its use to a sample with a small cross-sectional size may lead to biased standard errors, biased estimated parameters, and a weakened over-identification test (Windmeijer, 2005). Roodman (2009a) illustrates that the proliferation or excess of instruments is the primary cause of these problems. The author offers a unique strategy that

reduces the dimension of the instrumental variable's matrix. According to Roodman (2009b), the dimension of the matrices of instrumental variables is reduced. Due to the possibility that the regressors are endogenous, they must be instrumented with two lags of themselves and one lag of the first-difference in the level equation.

### Data Source

Institutional quality is proxied by control of corruption, which is scaled with a maximum score of 0 for total corruption and a maximum score of 100 for no corruption, according to the World Governance Indicator (WGI). Trade openness is net export as percentage of GDP from world bank database. Similarly, human capital from world bank proxied by school enrollment, primary (% gross). ATM machines for both banks are number of ATM machines per 100,000 adults and bank branches are number of bank branches per 100,000 adults.

### Results and Discussion

Table 1 below displays the descriptive statistics for each variable utilized in the study. Our findings indicate that for the dependent variable, the green GDP, the mean value is  $2.82e+11$ , and the minimum and maximum values are  $4.47e+09$  and  $1.24e+12$ , respectively, indicating that there are substantial disparities in green GDP among the various OIC countries.

The variable of Islamic financial inclusion of bank branches and ATM has the highest value of 21409 and lowest value of -44, also the highest of 65132 and lowest of 16 respectively. likewise, conventional financial inclusion is of the institutional quality has minimum and maximum values of 38.59 and 1.69 highest and lowest of bank branches respectively, also of 122.04 and 0.71 respectively. Institutional quality with highest of 87.204 and lowest of 0.47, with standard deviation of 24.465. High standard deviations indicate data dispersion relative to their means. Compared to other variables such as institutional quality, and financial inclusion, the standard deviation of Green GDP is  $2.76e+11$ . This implies that there are substantial differences in green GDP amongst OIC countries.

Table 1

#### Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
GGDP	180	$2.82e+11$	$2.76e+11$	$4.47e+09$	$1.24e+12$
IBB	180	1492.55	4474.972	-44	21409
BB	171	12.422	7.545	1.69	38.59
IATM	126	5250.754	13775.19	16	65132
ATM	171	43.743	28.868	.71	122.04
IQ	180	43.803	24.465	.474	87.204
TO	171	74.71	43.026	4.128	191.873
HC	180	100.714	10.892	72.015	119.556

Following the descriptive statistics is a correlation matrix (see Table 2) that depicts the degree of connection between the key variables. By examining the correlation coefficients, we found that collinearity was not a significant problem. Most of the correlation coefficients are lower than 0.6, so collinearity was not an issue that needed to be addressed in this study. This research's panel data series were suitable for accurate and robust estimations. Hence, no spurious regression was found.



Table 2  
*Matrix of Correlations*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) GGDP	1.000							
(2) IBB	0.126	1.000						
(3) BB	0.190	0.730	1.000					
(4) IATM	0.186	0.968	0.727	1.000				
(5) ATM	0.367	0.327	0.646	0.421	1.000			
(6) IQ	-0.069	-0.340	0.077	-0.296	0.494	1.000		
(7) TO	-0.228	-0.217	0.125	-0.181	0.433	0.854	1.000	
(8) HC	0.264	0.241	0.263	0.260	0.316	0.211	0.190	1.000

Table 3 below displays the acquired results on the effect of financial inclusion on green GDP in OIC countries. We can see that the coefficient of Islamic financial inclusion is statistically significant and denoted by a positive sign, showing a positive relationship between bank branches of Islamic banks and green GDP. When there is increase of Islamic bank branches by 1%, green GDP increases by 0.045%. The institution quality coefficient is negative, demonstrating a negative relationship between institution quality and green GDP. Trade openness is represented with a positive sign, indicating positive relationship between trade openness and green GDP. When trade openness increases by 1%, green GDP increases by 0.12%.

Table 3  
*Regression Results*

	Model (IBB)	Model (IATM)	Model (BB)	Model (ATM)
	lggdp	lggdp	lggdp	lggdp
I.LGGDP	0.344*** (0.118)	0.428*** (0.136)	<b>0.083</b> <b>(0.170)</b>	<b>0.220</b> <b>(0.208)</b>
LFI/LIFI	<b>0.045***</b> <b>(0.016)</b>	<b>0.010</b> <b>(0.116)</b>	<b>0.185***</b> <b>(0.038)</b>	<b>0.076</b> <b>(0.160)</b>
LIQ	-0.319*** (0.055)	-0.499*** (0.062)	-0.409*** (0.086)	-0.311*** (0.054)
LTO	0.120* (0.062)	0.195*** (0.047)	0.118* (0.070)	0.121* (0.063)
LHC	-0.468** (0.207)	-0.421* (0.223)	-0.518*** (0.195)	-0.500** (0.230)
CONS	19.618*** (3.030)	17.761*** (3.065)	26.867*** (4.362)	23.028*** (4.776)
AR(2) (p-value)	0.768	0.713	0.440	0.205
J-test (p-value)	0.224	0.118	0.306	0.640
No. of Instruments	12	12	12	12
No. of Countries	19	14	18	18
No. of Observations	132	98	126	126
Time dummies	No	No	No	No

Table 3 above shows no dynamic effect of conventional financial inclusion on green GDP. These results is similar between ATM and bank branches, indicating static effect between ATM and bank branches and green GDP. As a comparison preferred to be under similar method of estimates, this study did not go further on checking static model.

### **Conclusion**

The primary objective of this study is to investigate the impact of Islamic and conventional financial inclusion such as bank branches and number of ATM machines on green GDP in OIC countries. The data set included the years 2013 through 2021. This study\_employed the System GMM (SYS-GMM) estimator for estimate purposes. Two diagnostic tests based on Arrelano and Bond (1991) are conducted to investigate first and second order serial correlation in the errors in validating the reliability of the augmented results.

According to the findings, there is a statistically significant positive relationship between bank branches of Islamic banks on green GDP. However, conventional financial inclusion shows no dynamic effect using SGMM. This study adopts only DGMM to compare the results between the conventional and the Islamic, using fixed effect or random effect model could give better results yet the methods will be different and hence difficult to compare the results.

ATM machines of Islamic banks were insignificant a first, then turned to positive and significant after including population and investment into the model. Additionally, our findings reveal a positive correlation between trade openness and green GDP. These findings against few empirical evidence to the expanding body of research that relates greater openness led to environmental deterioration, income inequality, and an upsurge in environmentally destructive economic activities. This result has significant policy considerations that the government could implement to accelerate the growth of its green GDP. To minimize environmental contamination, the OIC governments should emphasize preserving and improving the quality of their institutions in to boost and develop green GDP in their respective nations. In addition, policymakers should establish effective government regulations to improve institution quality measurements. The governments should also promote green investment, which consists of investment projects and processes that enable adopting renewable energy sources, ecologically friendly technology, etc., reducing environmental pollution.

This paper contributes to existing studies in two ways. Firstly, it highlights the role of Islamic financial inclusion facilitated by Islamic banks within OIC countries. Secondly, it addresses the contemporary global concern of green GDP, wherein countries strive to boost their economies without causing environmental contamination.

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