IMPACT OF FINANCIAL DEVELOPMENT AND FINANCIAL TECHNOLOGY ON GREEN GROWTH

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ABSTRACT
Financial development and financial technology (Fintech) are well-known as important roles in economics which have the potential to promote sustainable economic growth and support environmentally-friendly initiatives, On the other hand, there also can damage the economy and environment. Most of the studies measured both economic and environmental performance by the green growth index which is used as a proxy of the dependent variable for measuring overall performance in terms of economic development, environmental sustainability, policy response, and quality of life, therefore, this study aims to investigate the impact of the financial development and financial technology on green growth using the generalized method of moments (GMM) based on the 25 High, Upper-middle income country with panel data during 2013 to 2021. This study employs principal component analysis (PCA) to construct an index with higher dimensions which are the financial development index that constructs from 4 dimensions consisting of access, dept, stability, efficiency, and financial technology index using a number of transactions through financial technology such as ATM, Point of sales and E-payment. The result of this study shows the result that financial development does not significantly on green growth. Despite, fintech has a positive significant effect on green growth, the interaction terms of fintech and financial development have a negative significant effect on green growth. These results suggest that policymakers and industry leaders should consider the potential environmental impacts of fintech and financial development when designing, and implementing policies and strategies

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INTRODUCTION

Green growth has become an interesting concept nowadays as it addresses the challenges of economic development and environmental sustainability. Green growth is an economic strategy that aims to achieve a framework to promote sustainable development such as quality of life, economic opportunity, and reducing the use of natural resources. Furthermore, environmental and social issues are more pressing than ever, and there is a growing awareness of the need to transition toward a more sustainable economy especially in high-income and upper-income country because a disproportionate share of global greenhouse gas emissions more than other levels of income country (Chancel, L., & Piketty, T., 2015), (Crippa, M, 2019) based on Our world in data with Global carbon project (2022) and the high-income and upper-income country tend to more developed and industrialized economies, which are more reliant on natural resources of energy that emit greenhouse gases and also have more developed industrial sectors, which can lead to higher emissions from manufacturing processes and industrial activities so the same environment problem in both of the high-income and upper-income country is climate change (IPCC, 2014) that caused by the release of greenhouse gases, primarily carbon dioxide into the atmosphere and it is a global problem which is affecting all countries regardless of their income level. The second problem is the increased use of natural resources by industrialized economies consist to Stuchtey, M et al., (2022), and Schandl, H et al., (2020), Even if High-income and upper-income country exactly has a high rate of economic growth but that is not enough for sustainability. Therefore, this study using uses based on 25 High, Upper-middle income countries with panel data from 2013 to 2021.

Even if the result of many studies which investigate the impact of financial technology (FinTech) on green growth have seveperspectivestive of results such as Song and Li (2020), Peng et al. (2021), Bo, Li et al. (2022), and Shobande and Ogbeifun (2022), suggest that financial development promotes green growth but conflict with Bui, (2020) and Jinquao, et al. (2022), from literature review, shows that Financial technology (FinTech) only have evidence from the positive effect on green growth such as Zhang, J. et al., (2020), Amin, M., & Din, A. U. (2020) and Cheung, A. (2019). Therefore, from literature review shows that less of studies on the interaction terms of financial development and fintech is the gap that useful help way to managing how to promote sustainable economic growth while minimizing negative impacts on the environment. The impact of the interaction between financial development and fintech on green growth is a crucial topic of research, as it can provide insights into the mechanisms through which these factors can influence environmental sustainability. Cao, J (2022) is a study that refers to the interaction term of financial development and technological innovation and the result shows that the interaction term between financial development and technological innovation increases the negative effect on green growth. The problem that studies related to this field have less evidence insight of the interaction term of financial development and fintech which is lead to the objectives of this study is attend to investigate the impact of the interaction term between financial development and fintech on Green Growth and the research question in this studies is how does the interaction between financial development and fintech impact environmental sustainability and what are the mechanisms through which it affects green growth?. Then, First, the study constructs a composite index by Principal component analysis such as the financial development index, fintech index, and Green Growth index. The financial development index covered financial institutions' indicators of 4 dimensions, Fintech index uses Number of the transaction (Million), Green Growth index in this study include 4 dimensions which are Economic development, Natural resources, Policy response, Quality of life, and control variable is Human capital, Openness, Industrialization, and Education. All of the control variables followed by most uses in studies from the literature

LITERATURE REVIEWS

Impact of Financial Development on Green Growth

Financial development plays an important role in an economy such as the allocation of funds to other economic sectors, short-term funding through the money market, and long term through the capital market. Financial development consists of four dimensions that can be used as indicators and characterizations of finance such as Dept refers to size and liquidity, Access refers to the ability of individuals and companies to access financial Services, Efficiency refers to the ability of an institution to provide financial services at low cost, sustainable income, and Stability refers to efficiently allocating resources, assessing and managing financial risks (World Bank Economic Review 14 (3): 597-605, reduces poverty and inequality by improving access to funding for the poor and vulnerable (Wilson et al., 2012). Studies of financial development usually use proxies from financial indicators, such as depth dimensions. Some studies that have explored the impact of financial development on green growth have considered four dimensions of financial development: depth, stability, efficiency, and depth, with depth being the most commonly used indicator. These studies use proxies that cover financial indicators of all dimensions. However, research findings on the impact of financial development on green growth are not consistent. Some studies, including Song and Li (2020), Peng et al. (2021), Bo Li et al. (2022), and Shobande and Ogbeifun (2022), suggest that financial development promotes green growth. In contrast, other studies, such as Bui (2020) and Jinquao et al. (2022), have found a negative relationship between financial development and green growth. Overall, it is clear that the relationship between financial development and green growth is complex and multifaceted. Therefore, further research is needed to better understand the nature of this relationship, including the role of financial technology in promoting sustainable economic growth.

Impact of Fintech on Green Growth

A number of studies have examined the relationship between fintech and environmental quality. For example, Cai and Zhang (2019) found that fintech innovation and financial development could improve environmental quality. Huang and Shen (2020) examined the impact of fintech development on green growth in China, finding that increased fintech development positively influenced the growth of green industries. Wang, Li, and Liu (2020) explored the moderating effect of financial openness on the relationship between fintech development and green growth. They found that financial openness enhanced the positive impact of fintech on green growth.

Other studies have focused on the role of fintech in financing sustainable development. For instance, the International Finance Corporation (IFC) has highlighted the potential of fintech solutions such as mobile payments, crowdfunding platforms, and digital financial services to close the financing gap for sustainable infrastructure projects in emerging markets (IFC, 2019). Similarly, the European Investment Bank (EIB) has highlighted the potential of fintech to support the transition to a low-carbon economy in Europe, through innovations such as green bonds and green digital platforms (EIB, 2020). Overall, the literature suggests that the interaction of fintech and financial development has the potential to support green growth, both through direct investment in green industries and through the provision of innovative financial solutions.

Impact of Financial Development and Fintech on Green Growth

To investigate the impact of interaction terms on green growth, several factors need to be considered, including financial development and financial technology. Many studies found that it has some studies on financial development or fintech but less of studies about the interaction terms of financial development and fintech such as Cao, J, et al., (2022) show that the interaction between financial development and technological innovation increases the negative effect on Green Growth, and control variable which is were used mutually by both factor such

as Education and Trade, followed by Bo, L, et al ., (2022), Industrialization and Human capital following by Cao, J, et al., (2022) and more studies such as Zhou, G et al., (2022),), Ni, G., (2022), Chieng, C, et al ., (2022) and Wang, W, et al., (2022) and lately still not have more evidence for studies on the impact of interaction term of Financial development and Fintech on Green Growth. From Literature review lead to the research question of this paper which is How does the interaction between financial development and fintech impact environmental sustainability and what are the mechanisms through which it affects green growth? Fintech can be an important enabler of financial inclusion, which is a critical element of sustainable and inclusive economic growth. Research has shown that increased access to financial services and products can lead to improved social welfare, increased economic productivity, and reduced poverty levels. Source: Ahmed, S., & Ahmed, M. (2020). Fintech can help reduce the environmental footprint of the financial sector. For example, digital payment systems can reduce the need for paper-based transactions and physical infrastructure, while blockchain technology can increase efficiency and reduce the need for intermediaries. Weber, R. H., & Wellbrock, C. (2018). Green finance and fintech—Embracing sustainable development. Journal of Sustainable Finance & Investment, 8(2), 128-143.
H1: Interact term of FD and FT

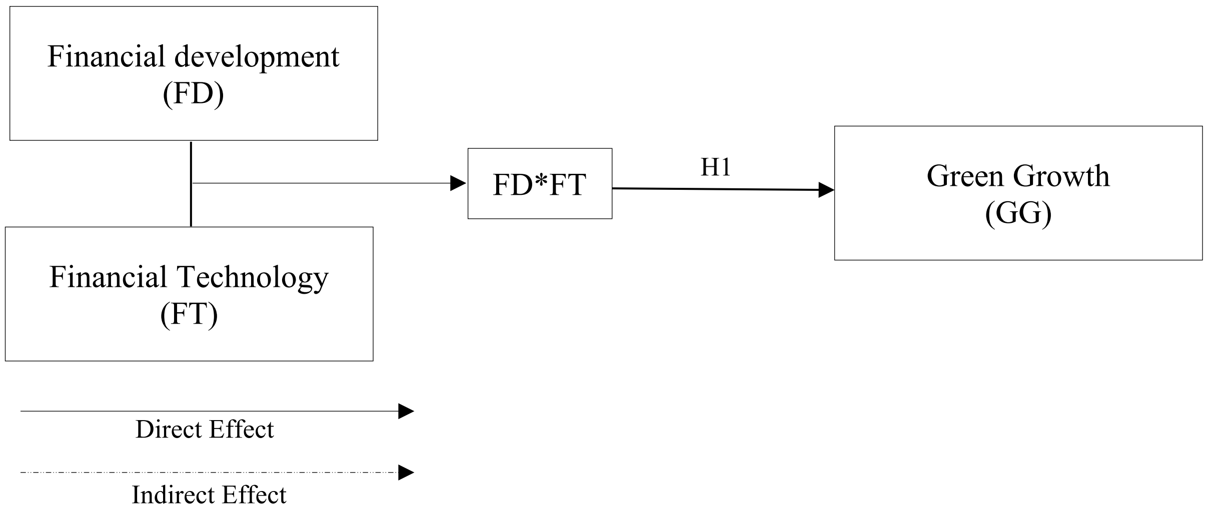

Figure 1 Conceptual Framework

RESEARCH METHODOLOGY

Data collection

This study collects data covering 2013-2021. The 25 High-income country is Austria, Argentina, Belgium, Bulgaria, Cyprus, Croatia, Czech, Estonia, Finland, Hungary, Ireland, Italy, Latvia, Mexico, North Macedonia, Norway, Netherlands, Portugal, Spain, Sweden, Greece, Poland, Switzerland, Thailand and Turkey.

Method,

This study starts with Unit Root Test and follows Guihuan and Yu (2014) to using Principal Component Analysis (PCA) to construct the financial development index and financial technology index so last step is GMM estimator was employed by following Arellano and Bond (1991) and Beck and Levine (2004) for using the GMM estimator to investigate the impact of financial development and financial technology on green growth.

Principle Component Analysis (PCA)

Principal Components are combinations of primitive variables, defined as linear combinations of primitive data. The importance of PCA is manage variable which has high-dimensions so this study attend to construct new proxy by using PCA method that is a powerful data-mining technique that reduces data dimensionality obtaining more interpretable representation of the system under investigation (Navas at el., 2008) and the equation described in the following equation form

$$\text{Index} = \sum_{i=1}^{j} \alpha_{ij} \frac{X_{ij}}{Sd(X_i)} \qquad (1)$$

When X_{ij} is Original data , $Sd(X_i)$ is standard deviation, α_{ij} is weight obtained from PCA

Unit root Test

For surely that all variable is stationary for analysis to avoid spurious regression and tested by Im, Pesaran and Shin (2003) which the most recommended tests, easier to use and more powerful by following Ozturk and Kalyoncu (2007), Mbarek and Rachdi (2009) and Hudea and Stancu (2012) and the following equation form is

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{\rho_i} \beta_{ij} \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it} \qquad (2)$$

Where Δy_{it} is the difference term of y_{it} which is panel data of country i at the time t, α is amount of lag order for difference terms, ρ_{it} is $\rho - 1$, X'_{it} is exogenous variable of country i at the time t and ε_{it} is random error of country i at the time t. The null hypothesis and the alternative hypothesis is

$H_0 : \alpha_i = 0$, for all i

$$H_1 \begin{cases} \alpha_i = 0, & \text{i=1,2,...,N} \\ \alpha_i < 0, & \text{i=N+1,N+2,...,N} \end{cases}$$

If reject null hypothesis that mean panel data has unit root (Not Stationary) and if not reject null hypothesis that mean panel data not has unit root (Stationary).

Panel cointegration Test

Panel cointegration Test is technique for estimate the long-term equilibrium. Let the cross-sectional data be constant (Intercepts) and the coefficients are the same for the first-stage regressors. Cointegration It is a property of data that can be analyzed without spurious regression problem and this study using Kao (1999)

$H_0 :\ \rho = 1$ (no cointegration)

$H_1 :\ \rho \neq 1$ (cointegration)

Panel Equation Testing

Panel equation test is test which decide what form is the panel cointegration model should be estimated between Pooled Estimator with fixed effect or random effects. For this study using Hausman Test.

H_0 : Random Effect

H_1 : Fixed Effect

If the test results accept the null hypothesis mean the model should be estimated in the Random Effects, if the test results reject the null hypothesis, the model should be estimated in the form of fixed effects.

Panel Estimation

This study using Generalized Method of Moments (GMM) model for estimate of the relationship between the independent and dependent variables, benefit is use when panel data time frame is short and not necessary to follow assumptions of normality (Kelejian & Prucha, 1999) and able to eliminate problems of cross country Therefore, the estimation equation for the GMM model can be written as following

$$y_{it} - y_{it} = \beta'(x_{it} - x_{it-1}) + \gamma'(Z_{it} - Z_{it-1}) + (u_{it} - u_{it-1}) \quad (3)$$

When $i = 1, 2, ..., n$ and $t = 1, 2, ..., T_i$ and However, from the equation, the bias increases if $y_{it-1} - y_{it-2}$ is related to the error term $(u_{it} - u_{it-1})$ Dynamic Panel OLS estimation is more appropriate but if using correct instrument, the Generalized Method of Moment (GMM) is effective and suitable for estimating equations. In general, lags are added two lags is y_{it-2} and not correlated with $(u_{it} - u_{it-1})$ therefore, the value of $y_{it-2}, k \geq 2$ is a correct instrument.

RESEARCH RESULTS

Descriptive statistic

Table 1 the nature of variables such as the mean, standard deviation, skewness, max, min and interpretation of related variables. The statistic descriptive of the variables in Table 1 shows that all variables have 225 observations. This table shows standard deviation is not much, mean, min and max are nearly and skewness which were considered for assessing normal data distribution, were acceptable ranged between ± 3.00 (Curran et al., 1996; Kline, 2005).

Table 1 Descriptive statistic

Variables	Mean	Std. Dev	Skew ness	Max	Min	Obs
Dependent variable						
Green growth index (GG)	-0.018	1.776	0.110	3.934	-3.807	225
Independent variables						
Financial development index (FD)	-0.011	1.330	0.288	3.949	-3.846	225
Financial technology index (FT)	0.006	1.192	1.320	5.552	-1.238	225
Interact term of FD and FT (FD*FT)	0.390	1.205	-0.278	4.904	-3.938	225
Control variables						
Trade openness (TRADE)	109.101	44.185	0.508	252.249	22.48	225
Industrialization (INV)	14.7103	5.769	1.151	34.650	3.884	225
Human capital (HDI)	16.7251	1.7167	0.085	20.028	12.94	225

Variables	Mean	Std. Dev	Skew ness	Max	Min	Obs
Education (EDU)	112.007	17.669	1.166	163.934	79.59	225

Note: Green growth index (GG) is proxy which measure by Economic development using GDP per capita (current US$), Natural resources dimensions using GDP per unit of energy use (PPP $ per kg of oil equivalent), CO_2 emissions (kg per PPP $ of GDP), Primary energy consumption per capita (kWh/person), CO_2 emission per capita, Policy response dimensions using Taxes on Energy (including fuel for transport), Research and development expenditure (% of GDP) and Quality of life dimensions using People using safely managed drinking water services (% of population) and control variable is Expected Years of Schooling as Human capital, Trade(%) as Openness, Manufacturing, value added (% of GDP) and Government expenditure on education, total (% of GDP) as EDU. All of the control variables followed by most uses in studies from the literature.

Result of Principal Component Analysis

The study use a training dataset by rescaling (one of normalized method) original data to find the loading value which is use to weigh with original data for constructing a composite index

Table 2 Eigenvalues

Number	Values	Proportion	Cumulative proportion
Green Growth			
PC1	3.153	0.394	0.394
PC2	2.054	0.256	0.651
PC3	1.241	0.155	0.806
PC4	0.656	0.082	0.888
PC5	0.346	0.043	0.931
PC6	0.308	0.038	0.970
PC7	0.146	0.018	0.988
PC8	0.093	0.011	1
Financial development			
PC1	1.813	0.453	0.453
PC2	0.947	0.236	0.690
PC3	0.734	0.183	0.873
PC4	0.504	0.126	1
Financial technology			
PC1	1.428	0.476	0.476
PC2	0.961	0.320	0.796
PC3	0.610	0.203	1

Note: Number with underline is maximum value of all principal component values.

Table 2 shows that the max value of the proportion of PC1 from Green Growth index, Financial development index, and Financial technology index is 0.394, 0.453 and 0.476 which is more than other PC means PC1 is fitter than others for use to explain the total variability in the data and an eigenvalue greater than 1 and another component Therefore, this study using PC1 to construct index. The principal component in the Financial development index, and Financial technology index is not necessary to use the rotated factor solution but Green Growth index use rotated factor solution which describe in Table 3

Table 3 Rotated loadings

Variable	Factor 1	Factor 2	Factor 3
G1	0.879	-0.146	-0.094
G2	-0.034	0.857	-0.041
G3	-0.506	-0.033	0.709
G4	0.711	-0.222	0.288
Variable	**Factor 1**	**Factor 2**	**Factor 3**
G5	0.326	-0.195	0.760
G6	-0.452	-0.391	0.116
G7	0.748	-0.189	0.043
G8	-0.261	0.887	-0.139

Source: Authors

In this table, G1, G2, G3, …G8 are the names of the variables and Factor 1, Factor 2, and Factor 3 are the rotated factors. The values in Table 3 represent the factor loadings of the variables on the rotated factors. The method of rotation used in this analysis was Varimax rotation, which maximizes the interpretability of the factor loadings and in the table shows that variable G1 has a high loading of 0.879 on Factor 1, indicating a strong association between the variable and the factor that consists of many studies use the threshold of 0.3 for determining "high" factor loadings such as all variable except G2, G3, G6 and G8 has factor loadings greater than 0.3 are considered high and indicate a strong association between the variable and the factor but G2, G3, G6 and G8 may indicate an association between the variable and the factor, but it's not as strong as factor loadings greater than 0.3. and then used rotated loadings multiply with original data to construct Green Growth index. Table 4 shows Factor Loadings of Green Growth, Financial development and financial technology.

Table 3 Factor Loadings

Variables	Green Growth	Financial development	Financial technology
G1	0.879		
G2	-0.034		
G3	-0.506		
G4	0.711		
G5	0.326		
G6	-0.452		
G7	0.748		
G8	-0.261		
FD1		0.359	
FD2		0.433	
FD3		-0.599	
FD4		0.568	
FT1			0.467
FT2			0.690
FT3			0.552

Note: G1 is GDP per capita (current US$), G2 is GDP per unit of energy use (PPP $ per kg of oil equivalent), G3 is CO_2 emissions (kg per PPP $ of GDP), G4 is Primary energy consumption per capita (kWh/person), G5 is CO_2 emission per capita, G6 is Taxes on Energy (including fuel for transport),G7 is Research and development expenditure (% of GDP), G8 is People using safely managed drinking water services (% of population), FD1 is Number of deposit accounts with commercial banks per 1,000 adults, FD2 is Bank Z-score (%), FD3 is Bank net interest margin (%), Private credit by deposit money banks and other financial institutions to GDP (%), FT1 is Number of ATM transaction (Million),FT2 is Number of Point of sales transaction (Million) and FT3 is Number of E-payment transaction (Million).

Result of Unit root test

The result in Table 4, Table 5 show that all proxy tested by Im, Pesaran and Shin Test (IPS) which reject null hypothesis at 5% level of significance therefore, all variables are stationary at first order differences level or integrated of order I(1), which necessary for cointegration test in next step.

Table 4 Unit root Test

Variable	Unit root Test	Test equation	P-Value at Level	P-Value at 1st Different	Conclusion
GGI	Fisher-PP	none	0.000** (91.808)	0.000** (172.498)	
		intercept	0.491 (49.560)	0.000** (101.087)	Stationary at I(1)
		Intercept and trend	0.093 (63.586)	0.000** (107.609)	
FD	Im, Pesaran, Shin	intercept	0.200 (-0.841)	0.000** (-4.687)	Stationary at I(1)
		Intercept and trend	0.754 (0.688)	0.037 (-1.785)	
FT	Im, Pesaran, Shin	intercept	1.000 (9.859)	0.001** (-2.981)	Stationary at I(1)
		Intercept and trend	0.964 (1.809)	0.031** (-1.862)	
FD*FT	Im, Pesaran, Shin	intercept	0.832 (0.965)	0.003** (-2.703)	Stationary at I(1)
		Intercept and trend	0.933 (1.503)	0.032** (-1.841)	
TRADE	ADF Fisher	none	1.000 (15.842)	0.000** (212.075)	
		intercept	0.157 (59.993)	0.000** (128.388)	Stationary at I(1)
		Intercept and trend	0.000 (89.613)	0.104 (62.899)	
INV	Breitung	Intercept and trend	0.968 (1.858)	0.000** (-8.652)	Stationary at I(1)
HDI	Breitung	Intercept and trend	1.000 (6.759)	0.005** (-2.563)	Stationary at I(1)
EDU	ADF Fisher	none	0.998 (21.721)	0.000** (197.553)	
		intercept	0.000 (104.923)	0.000** (101.230)	Stationary at I(1)
		Intercept and trend	0.142 (60.716)	0.095 (63.505)	

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel cointegration Test

Table 5 Panel cointegration Test: Kao test (1999)

Statistic Test	P-Value (t-Statistic)
ADF-Test	0.019**(-2.068)

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

This table shows the p-value of the Kao test (1999) is less than the significance level at 5% means the null hypothesis of no cointegration is rejected and it can be concluded that there is cointegration implying that there is a common long-run equilibrium.

Result of Panel Equation Testing

This study uses the Hausman test which is a statistical test used to compare the relative performance of two models, typically a fixed effects model (FE) and a random effects model (RE). The result of the Hausman Test shows in Table 5 and the panel equation following below

$$GG_{it} = \beta_0 + \beta_1 GG_{it-1} + \beta_2 (FD)_{it} + \beta_3 (FT)_{it} + \beta_4 (FD * FT)_{it} + \beta_5 (TRADE)_{it} + \beta_6 (INV)_{it} + \beta_7 (HDI)_{it} + \beta_8 (EDU)_{it} + \varepsilon_{it} \quad (4)$$

Table 6 Hausman Test

Test Summary	Chi-sq. Statistic	Chi-Sq d.f	P-Value
Cross-section random	27.868	8	0.0005***

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 7 Compare R^2 between fixed effect model and random effect model

Type of effect model	R-Square
Fixed effect model	0.9873
Random effect model	0.9843

Table 6 shows that Chi-sq. The statistic in Hausman test rejects the null hypothesis with significance at 5% means fixed effects model (FE) is more effective than the random effects model (RE) and Table 6 show R-Square of the fixed effect model more than the random effect model that consists with our result in Table 7.

Result of Panel Generalized Method of Moments

Results of the Panel Generalized Method of Moments are shown in Table 9, Table 7 shows the result of Pooled ordinary least squares method, and Table 8 shows the Fixed effect model (within OLS). All of the estimate methods followed the equation (FE)

Table 8 Pooled Ordinary Least Squares Method

Dependent Variable: GG — Method: Pooled Ordinary Least Squares Method

Periods includes: 8 — Cross section includes: 25

Total panel observations: 199

Variable	Coefficient	Std. Error	t-Statistic	P-Value
GG(-1)	0.949	0.014	67.709	0.000**
FD	0.002	0.018	0.156	0.875
FT	-0.003	0.015	-0.244	0.806
FD*FT	0.004	0.013	0.352	0.725
TRADE	0.000	0.000	1.815	0.071
INV	-0.003	0.003	-1.103	0.271

Dependent Variable: GG		Method: Pooled Ordinary Least Squares Method		
Periods includes: 8		Cross section includes: 25		
Total panel observations: 199				
HDI	0.019	0.015	1.253	0.211
EDU	-0.000	0.001	-0.070	0.943
C	-0.358	0.209	-1.710	0.088

The results indicate that financial development and fintech does have a significant impact on green growth. The R-squared value of the model is 0.949, indicating that the model explains 94% of the variation in the dependent variable.

Table 9 Fixed effect model

Dependent Variable: GG		Method: Fixed effect model		
Periods includes: 8		Cross section includes: 25		
Total panel observations: 199				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**P-Value**
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**P-Value**
GG(-1)	0.616	0.081	7.551	0.000**
FD	0.124	0.060	2.066	0.040**
FT	0.027	0.032	0.824	0.410
FD*FT	-0.015	0.038	-0.412	0.680
TRADE	0.004	0.002	1.659	0.098
INV	0.001	0.005	0.173	0.862
HDI	0.032	0.068	0.479	0.631
EDU	0.003	0.005	0.656	0.512
C	-1.410	0.928	-1.518	0.130

Table 9 shows the results indicate that financial development has a positive and statistically significant impact on green growth. The coefficient for financial development is 0.060, for interact term is -0.015 and for fintech is 0.410. The R-squared value of the model is 0.616, indicating that the model explains 61% of the variation in the dependent variable.

Table 10 Two-step Difference GMM

Dependent Variable: GG		Method: Two-step Difference GMM		
Periods includes: 8		Cross section includes: 25		
Total panel observations: 199				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**P-Value**
GG(-1)	0.648	0.087	7.422	0.000**
FD	0.014	0.083	0.178	0.858
FT	0.129	0.052	2.485	0.013**
FD*FT	-0.109	0.039	-2.740	0.006**
TRADE	0.011	0.003	3.300	0.001**
INV	-0.001	0.016	-0.118	0.905
HDI	-0.003	0.089	-0.037	0.969
EDU	0.016	0.006	2.587	0.010**

Table 10 shows the results indicate fintech have a positive and statistically significant impact on green growth at a 5% level. For the effect of Financial development on Green Growth, our results show a positive but not significant effect which may be because that when studies in High, Upper income country which is following by Demand-Following concept (Smith, J. D,

2005) means that when a country has a high rate of economic growth. The role of financial development is decreasing accordingly. And the interaction term between financial development and fintech is have a negative significant impact on green growth at a 5% level which means the effect of Fintech on green growth depends on level of financial development. Specifically, as long as financial development increase, the fluence of fintech on dependent variable decrease consist with (Li, Ma, & Yao, 2020) and (Yawson & Anokye, 2021)
The coefficient for interact term is -1.09 and for fintech is 0.129. The R-squared value of the model is 0.72, indicating that the model explains 64% of the variation in the dependent variable more than the R-squared value of fixed effect model which that the model explains 61% of the variation in the dependent variable and lag of dependent variable coefficient is 0.648 more than 0.616 from fixed model.

Finalized Model

Finalized Model shows this study is based on the paper Cao, J (2022) and the idea of studies and constructing green growth index by Estella Kim et al., (2014) which suggest variables that can use in the Green Growth studies field, Ming C et al., (2017), suggest method for construct composite index and Zhou, R (2022) shows difference dimensions of green growth,
In this study, financial development refers to the development of financial institutions, while fintech involves the use of technology to deliver financial services. The framework suggests that the interaction between financial development and fintech can enhance the effectiveness of promote sustainable economic growth. And financial technology (fintech) has the potential to play a crucial role in promoting green growth. According to Song et al., (2021), fintech can improve the accessibility, efficiency, and inclusivity of financial services, making it easier for individuals and businesses to invest in green projects and technologies. The integration of fintech into financial systems can also facilitate the monitoring and tracking of green investments, enabling better assessment of their environmental impact (Zhang et al., 2020). The conceptual framework also considers other factors that can influence the interaction between financial development, fintech, and green growth. The framework aims to investigate how interaction terms between financial development and fintech in promoting green growth.

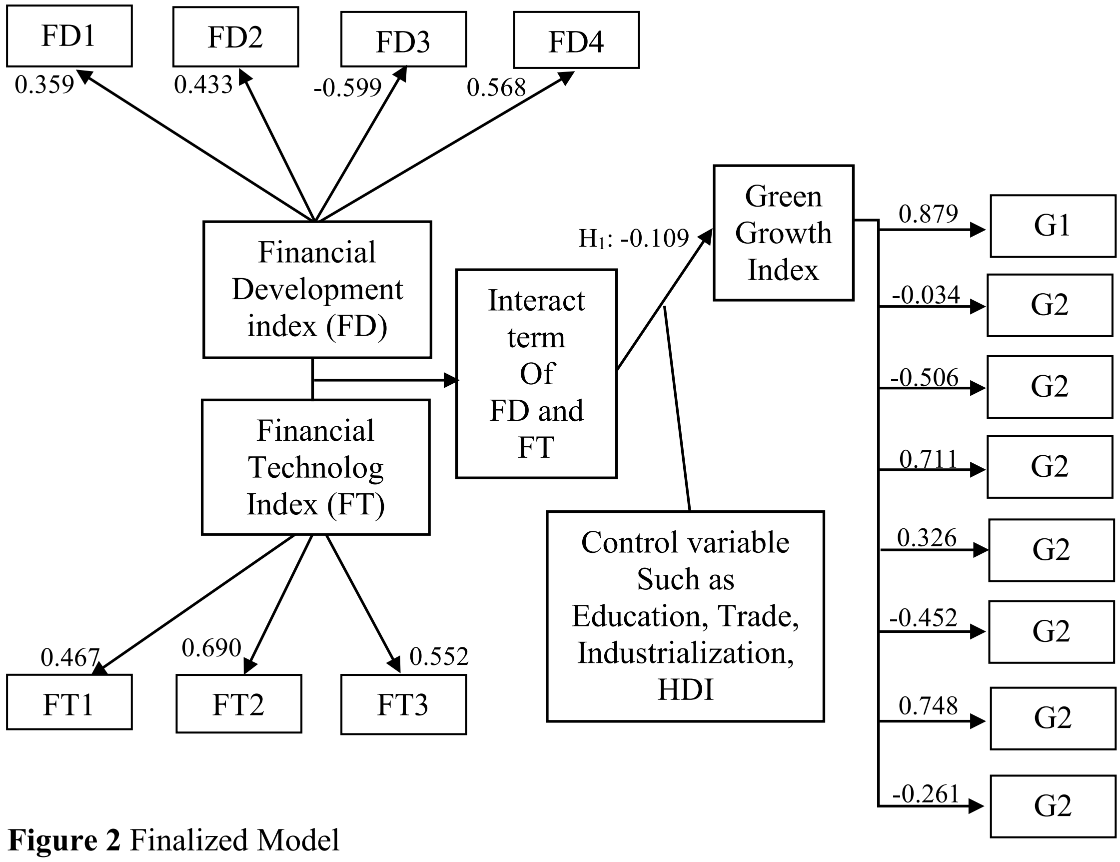

Figure 2 Finalized Model
Note: Interact term of FD and FT refers to FD*FT

Table 11 Standardized Estimate, Unstandardized Estimate, Standard Error, t-value, z-value, and p-value

Variables	β	b	S.E.	t-value	P-value
H_1: FD*FT→ GG	0.015	-0.109	0.297	-2.740	0.006**

Note: β refers to standardized estimate, b refers to unstandardized estimate, S.E. refers to standard error, *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 11 shows **P-value** is significant at 5% levels imply that reject Null Hypothesis with P-value is 0.006 and coefficient is 0.015 means interaction term between Financial development and Fintech directly to Green Growth.

DISCUSSION & CONCLUSION

In conclusion, this study aimed to investigate the impact of financial development and fintech on green growth. Using a panel data analysis of 25 High, Upper-Middle income countries covering 2013 until 2021, Our results showed that the interaction term of financial development and fintech have a negative significant on green growth consistent with Jianhong Cao (2022). These findings suggest that financial development in financial institutions is maybe not necessary in the role of the environment. the reason that can explain how the difference between the result and the literature review is the financial market is more potential to promote green growth than the financial institution such as green bond and green finance consist with Guangyou Zhou (2022) which found that green finance promotes green growth but these studies use the variable that measured financial institution development or maybe when studies in High, Upper-income country which is following by Demand-Following concept (Smith, J. D, 2005) means that when a country has a high rate of economic growth. The role of financial

development is decreasing accordingly. Andhe result shows that fintech has a positive significant on green growth implying that fintech promote green growth and sustainable through financial service Cheah and Ridout (2021) and B.vander Zwaan, (2021)
However, it is important to note that our study has some limitations, such as a limitation of data such as sample size, time, access to the database, and missing comparison of the result with other income countries. Future research can use these limitations by using a sample in other level-income countries and regions and considering other factors that may affect on green growth. Overall, this study provides valuable insights into the role of financial development and fintech in promoting green growth and highlights the importance of considering these factors in sustainability policies and initiatives such as promoting financial technology to encourage financial development through financial services because fintech companies have been able to improve the efficiency of financial transactions, reducing the need for paper-based systems and physical infrastructure. This has led to a reduction in carbon emissions and other environmental impacts and finally led to economic growth along with a sustainable environment.

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