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Research Article

The causal relationship between financial markets, financial institutions and financial development: Findings from Panel Granger causality analysis

Finansal piyasalar, finansal kurumlar ve finansal gelişmişlik arasındaki nedensellik ilişkisi: Panel Granger nedensellik analizine ait bulgular

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Abstract

This study aims to determine the existence and direction of the causality among financial markets, financial institutions, and financial development (FD). To achieve this, six indicators are used: a financial development index, a financial institutions index, financial institutions' access, financial institutions' depth, financial markets' depth, and financial markets' access. The model examines whether financial markets and institutions have an impact on foreign direct investment (FDI). The variables in the model are rendered stationary to prepare for the causality analysis. The panel Granger causality analysis reveals both unidirectional and bilateral causality among the indicators of FD, financial markets, and financial institutions. The findings suggest that financial development, financial markets, and institutions are integral parts of a well-functioning financial system.

Keywords: Financial Markets, Financial Institutions, Financial Development, Panel Granger Causality Analysis

Jel Codes: G15, G17, G20

Öz

Yapılan çalışmanın amacı; finansal piyasalar, finansal kurumlar ve finansal gelişmişlik arasındaki nedensellik ilişkisinin varlığını ve yönünü tespit etmektir. Bu tespiti gerçekleştirmek için finansal gelişmişlik endeksi, finansal kurumlar endeksi, finansal kurumlara erişim, finansal kurumlarda derinlik, finansal piyasalarda derinlik ve finansal piyasalara erişim olmak üzere altı gösterge kullanılmıştır. Finansal piyasalar ve finansal kurumların, finansal gelişmişlik üzerinde etkisi olup olmadığı incelenmiştir. Modeldeki değişkenler durağan hâle getirilerek nedensellik analizine hazır duruma getirilmiştir. Panel Granger Nedensellik analizi sonucunda; finansal gelişmişlik, finansal piyasalar ve finansal kurumlar göstergeleri arasında gerek tek, gerekse de çift yönlü nedensellik ilişkileri saptanmıştır. Bu bulgular; finansal gelişmişlik, finansal piyasalar ve finansal kurumların bütün hâlinde çalışan bir finansal sistemin parçası olduğunu ortaya koymaktadır.

Anahtar Kelimeler: Finansal Piyasalar, Finansal Kurumlar, Finansal Gelişmişlik, Panel Granger Nedensellik Analizi

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Introduction

In the present era, a country's ability to adapt to both favourable and unfavourable economic conditions and remain competitive at the forefront is fundamentally rooted in the existence of an effective financial system. Upon referring to the financial system, the markets and institutions operating within a set of rules come to mind. These units primarily facilitate the transfer of funds from surplus to deficit units. In short, the financial system supports economic growth (EG) and development (ED) by distributing resources in a balanced manner.

The existence of an efficient financial system forms the foundation of financial development (FD). A country's primary method for enhancing its financial development (FD) is through regulating its financial system. This system comprises fund providers and demanders, financial instruments, legal and institutional arrangements, and financial intermediaries. Thus, financial systems channel funds from individuals, institutions, and organisations with surplus resources to those in need. Diversifying and expanding the range of financial intermediaries, institutions, and instruments is crucial. This expansion directly correlates with development, and achieving a stable financial system is a key means of enhancing both financial development (FD) and economic development (ED) (Afşar, 2006).

However, this structure—comprising institutions, markets, and instruments within the economy—operates under specific rules and regulations. Its functions include facilitating the buying and selling of goods and services, mobilising savings, financing investments, enabling resource transfers, mitigating asymmetric information issues, broadening ownership, and managing payments and risks. Maintaining a stable financial system requires fulfilling these roles effectively. This responsibility typically falls to regulatory authorities within the economic system (Levine, 2004).

Financial markets (FMs) enable economic units with fund surpluses and deficits to interact, facilitating the flow of funds between them. In other words, they activate savings and transfer funds from providers to demanders. FMs serve two primary functions: increasing capital accumulation through savings and ensuring efficient fund utilisation (Taner & Akkaya, 2004).

A key aspect of FMs is their division into the money market, where short-term fund supply and demand converge, and the capital market, where long-term fund supply and demand meet. The money market includes institutions such as financial institutions, commercial banks, and the Central Bank (CB). Conversely, the capital market encompasses financial products and institutions, such as small savings, investment trusts, investment funds, firms, and social security organisations. Fund providers and demanders can invest in their preferred market, as some institutions serve both markets, enabling a constant flow of funds between them. This flow contributes to the economy by:

Supporting increases in national income and welfare through efficient use of individual savings;

Balancing income distribution by broadening ownership;

Establishing a risk-return balance through diversification;

Transforming small, scattered savings into significant investments facilitates the rise of major firms (Taner & Akkaya, 2009).

Financial institutions, also known as financial intermediaries, connect fund providers and demanders to facilitate fund transfers. Their duties include supporting risk diversification to minimise risk, offering financial advisory and portfolio management services, reducing capital costs, and fostering market development through innovation. The Central Bank (CB), as the most critical institution, regulates and manages monetary policies, including the issuance and distribution of banknotes. Consequently, CB decisions influence supply and demand in the economy, affecting prices and wages (Taner & Akkaya, 2009).

Countries with evolving and diverse FMs, institutions, and financial instruments are believed to possess an effective financial system. Thus, an effective economic system fosters the concept of FD.

FD combines two financial indicators: financial expansion and financial depth. Key points regarding FD include:

1. Countries with low foreign direct investment (FDI) face higher costs for foreign fund transfers, negatively impacting them.

2. In countries with high foreign direct investment (FDI), FDI can mitigate the adverse effects of exchange rate depreciation.

3. Financial institutions should prioritise effectiveness and accessibility over mere quantity, ensuring they serve people experiencing poverty.

4. Addressing asymmetric information, a significant barrier to FM development, requires attention (Marcelin & Mathur, 2014; Jeanneney & Kpodar, 2011; Krishnan, 2011; Alfaro, Özcan Kalemli & Sayek, 2009; Federici & Caprioli, 2009; Aslan & Korap, 2006; Fitzgerald, 2006; Skaden, 2000; Liu, 1998).

The study aims to measure the impact of financial markets and financial institutions on financial development. Causality analysis has been used to realise this measurement. Other objectives of the study include determining the relationship between financial markets, financial institutions, and financial development variables, as well as testing the interaction between the sub-variables of these variables. Additionally, the study examines the impact of financial markets and institutions on financial development through a causality analysis, with hypotheses established. In summary, the objective is to determine whether the concepts of financial markets, financial institutions, and financial development are mutually integrated. These hypotheses are as follows:

H_0: Financial markets and financial institutions do not affect economic development.

H_1: Financial markets and financial institutions affect financial development.

These hypotheses are the main hypotheses that determine the primary purpose of the study, and auxiliary and subsidiary hypotheses are included in the findings section. Studies testing these hypotheses are reviewed below.

Shah, Yasmeen, and Padda (2019) measured the relationship between financial development, institutions, and the environment. It was suggested that increased financial development through industrialisation might have negatively affected the environment, but this impact could be mitigated through strong institutions. Ahmed (2016) examined the interaction between financial markets, financial development, and economic growth. The findings support the study's purpose, indicating that financial markets, financial development, and growth are interrelated. In a study by Yu, Hassan, and Sanchez (2012), the relationship between financial development, stock market development, and economic growth was examined using Granger causality analysis. The Granger findings revealed a short-term relationship between finance and growth, suggesting that financial development and stock market development gradually enhanced economic growth. Voghouei, Azali, and Jamali (2011) proceeded from the assumption that financial development has a positive impact on economic growth, identifying the factors that determine financial development. Their analysis concluded that financial institutions, trade, financial market openness, legal traditions, and political economy supported financial development. Demetriades and Law (2006) determined that the quality of financial institutions enhanced financial development, with such enhancement varying by countries' income levels. Fergusson (2006) emphasised that well-functioning and sufficient financial institutions contributed to economic development, and achieving such improvement requires advanced financial markets.

As evidenced by the studies reviewed, it is observed that financial markets and institutions have a predominantly positive influence on economic development.

Literature review

This section critically evaluates empirical findings from studies on financial markets, financial institutions, and financial development, which form the basis of this study's purpose.

Research highlights several key insights. Promoting financial development, improving institutional quality, and achieving sustainable growth requires mitigating the adverse effects of trade and encouraging exports (Asghar et al., 2024). Financial development and technological innovations boost renewable energy consumption, while banking sector stability supports environmental sustainability (Athari, 2023). Institutional quality has been found to positively impact financial development and increase it in Sub-Saharan African Countries (Abaidoo & Agyapong, 2022). In a study analysing the effect of the quality of financial institutions on financial development, it was determined that institutional quality and national culture support financial development, a result in line with the financial socialisation theory (Khan et al., 2022). Financial inclusion, regulation, and institutional quality have a positive influence on economic growth. Institutional quality also enhances financial inclusion, and strong, independent, high-quality financial institutions with robust regulations are essential for Africa's economic growth (Ofoeda et al., 2022). Institutional quality and technological innovation, alongside financial development, reduce CO2 emissions, fostering a sustainable environment (Jianguo et al., 2022). Similarly, institutional quality and financial development promote sustainable green economic growth (Ahmed et al., 2022). In developing economies, financial development and human

capital have a positive impact on economic growth (Sarwar et al., 2021). In Indonesia, industrialisation and financial development are the most significant long-term drivers of economic growth (Elfaki, Handoyo & Ibrahim, 2021). Although financial markets have a limited impact on growth, both markets and institutions contribute to economic growth (Purewal & Haini, 2022). A non-linear relationship exists between finance and innovation, amplified by market institutions up to a threshold (Trinugroho et al., 2021). A stable macroeconomic structure, high-quality financial institutions, and optimal financial and economic development also bolster economic growth (Ehigiamusoe & Samsurijan, 2020). Financial institutions play a crucial role in strengthening financial development, which, in turn, enhances economic growth (Fernández & Tamayo, 2017). Corruption has a significant impact on the banking sector, while corruption, laws, and order affect stock markets. Trade deficits impact all areas of financial development, with economic integration playing a key role in driving per capita Gross Domestic Product (GDP) growth (Cherif & Dreger, 2016). Financial development has a positive impact on economic growth, although financial markets exhibit a negative relationship with growth, while institutions have a positive influence (Ahmed, 2016). Inadequate financial institutions hinder financial sector growth innovation and increase credit costs, exacerbating asymmetric information issues (Marcelin & Mathur, 2014). The impact of institutional quality on financial development has been analysed, and it has been found that high-quality institutions can positively affect financial development, especially in the banking sector (Law & Azman-Saini, 2012). Based on the finding that financial development positively impacts economic growth, the determinants of financial development have been analysed. As a result of this analysis, it was revealed that financial institutions, the openness of commercial and financial markets, legal traditions, and political economy factors all encourage financial development (Voghouei, Azali, & Jamali, 2011). It is stated that political institutions have a positive effect on financial development in the short run, and this effect serves as an indicator of democratic transformation (Huang, 2010). Stable economic development requires commercial banks to diversify risks and improve information flow (Wu, Hou & Cheng, 2010). Per capita income and institutional quality shape financial development in banking and capital markets (Law & Habibullah, 2009). Trade deficits and institutions promote financial development, whereas cultural factors and contract enforcement costs impede it (Herger, Hodler & Lobsiger, 2008). The impact of institutional quality on financial development varies by institution type (Law & Saini-Azman, 2008). Countries with robust, sufficient financial institutions exhibit high economic development, necessitating advanced financial markets (Fergusson, 2006). Middle-income countries with high-quality institutions exhibit elevated financial development, whereas low-income countries with weak institutions lag (Demetriades & Law, 2006). Financial development drives economic growth, with a bilateral causality that strengthens over more extended periods (Calderon & Liu, 2003). Financial development has a direct impact on growth, although neither bank-based nor market-based systems dominate (Levine, 2002). Finally, financial markets support development and growth, which in turn fosters market formation (Greenwood & Smith, 1997).

There are no studies in the literature that directly examine the relationship between financial development, financial markets and financial institutions. Generally, the relationship between financial development and economic growth is analysed, and financial markets and financial institutions are included as control variables. However, it has been found that financial markets and financial institutions increase financial development, even when controlling for these variables. In the present study, the relationship between financial development, financial markets, and financial institutions, as well as the direction of this relationship, was determined using a Panel Granger Causality test. An attempt was made to contribute to the existing literature. The aim is to determine whether there is an interaction between financial development, financial markets, and financial institutions.

Methodology

This section outlines the dataset that forms the research sample, the variables used, and the analytical methods employed.

The sample of the study

The research utilises a panel dataset covering 183 countries from 1980 to 2021. The study incorporates nine variables: the Financial Markets Efficiency Index (FME), the Financial Markets Access Index (FMA), the Financial Markets Depth Index (FMD), the Financial Markets Index (FM), the Financial Institutions Efficiency Index (FIE), the Financial Institutions Depth Index (FID), the Financial Institutions Access Index (FIA), the Financial Institutions Index (FI), and the Financial Development Index (FD).

The annual dataset was sourced from the International Monetary Fund (IMF) website. Therefore, the research relies on secondary data and does not require approval from an ethics committee. Information about the sample underscores the study's limitations. It is assumed that all data, constructed indexes, and software used in the analysis are accurate and reliable.

A three-step approach was employed to construct the dataset, which consists of nine indexes: normalising the variables, aggregating them into sub-indexes based on their functions, and transforming the sub-indexes into final composite indexes (Svirydzenka, 2016).

The method of the study

The study adopts panel data analysis as its econometric methodology. Panel data refers to data collected on multiple variables over a specified period, incorporating both cross-sectional and time-series elements (Tatoğlu, 2013a).

Given the focus on causality analysis, the stationarity of variables is first evaluated. Stationarity indicates that a dataset fluctuates around a horizontal axis rather than showing a consistent increase or decrease over time. Testing for stationarity is essential, as non-stationary variables must be differenced to avoid spurious regression issues. Two generations of unit root tests assess stationarity: first-generation tests ignore cross-sectional dependence (CSD), while second-generation tests account for it (Gürkan et al., 2014; Birgili & Düzer, 2010; Güloğlu & İspir, 2009).

Once the data are stabilised via unit root tests, the study advances to its primary goal: Granger causality analysis. In panel data causality analysis, the homogeneity or heterogeneity of variables determines the test type. Here, the delta test by Pesaran and Yamagata (2008) is applied, with its test statistic calculated as:

$$\tilde{\Delta} = \sqrt{N}\ \tilde{N}^{-1}\ \tilde{s} - k\ \sqrt{2k} \quad (1)$$

The adjusted delta test statistic is provided in Equation 2:

$$\tilde{\Delta}\ adj = \sqrt{N}\ \tilde{N}^{-1}\ \tilde{s} - E(\tilde{Z}\ it)\ \sqrt{Var(\tilde{Z}\ it)} \quad (2)$$

The hypotheses for Pesaran and Yamagata's (2008) delta test are as follows:

Ho: $\beta 1 = \beta 2 = \cdots = \beta n = \beta$ (Homogeneous for all β_i), $(i = 1, \ldots, n)$

H_A: At least one β_i differs from the others (Heterogeneous).

If the test statistic exceeds the critical value, H_0 is rejected, indicating heterogeneous data.

The study then conducts a Granger causality analysis, which examines the causal relationships between two variables to determine whether they are unidirectional or bidirectional. Introduced by Granger (1969), this method tests:

H_1: x does not Granger-cause y.

H_2: y does not Granger-cause x.

The acceptance of H_1 implies that x is not the Granger cause of y, while the rejection of H_1 indicates that x is the Granger cause of y. The acceptance of H_2 means that y is not the Granger cause of x, while the rejection of H_2 suggests that y is the Granger cause of x. If both hypotheses are accepted, no causality exists. If both hypotheses are rejected, a bilateral causality exists (Granger, 1969).

Findings

In the research, a 42-year panel data set covering the period from 1980 to 2021 was first created. Then, regression analysis was performed to test the significance of the nine indices in the model. As a result of the regression analysis, even though the established model is significant, these three variables are excluded from the model due to a collinearity problem between the financial markets index (FM), financial institutions efficiency index (FIE), and financial markets efficiency index (FME) variables.

Then, the hypotheses of the model were formed as follows:

H_0: Financial markets and financial institutions do not affect financial development.

H_1: Financial markets and financial institutions have an impact on economic development. As a result of the hypotheses, regression analysis was performed to test the significance of the model, and the results are given in Table 1.

Table 1: The Significance of the Model

Group Variable: Countries Number of observations (N): 7686 Number of groups (n): 183 Observations per group (T): 42 Correlation (u_i, Xb): 0.000 Probability: 0.000 Note: FM, FIE and FME were omitted because of collinearity						
FD	**Coefficient**	**Standard Error**	**z**	**P>|z|**	**% 95 Confidence Interval Minimum / Maximum**	
FI	0.5651215	0.0065923	85.72	0.000	0.5522008	0.5780422
FID	-0.0368064	0.0050945	-7.22	0.000	-0.0467914	-0.0268214
FIA	-0.0288311	0.0043588	-6.61	0.000	-0.0373742	-0.0202881
FMD	0.2954587	0.0028155	104.94	0.000	0.2899405	0.3009769
FMA	0.1674676	0.0029685	56.42	0.000	0.1616495	0.1732856
constant	0.0070869	0.0021045	3.37	0.001	0.0029622	0.0112116
sigma_u: 0.02589036 sigma_e: 0.02019754 rho: 0.6216646 R-square: 0.9753						

Table 1 shows the results of the regression analysis. As a result of the regression analysis, the probability value (p) was found to be 0. This means that the null hypothesis is rejected, and hypothesis H_1 is accepted at a 95% confidence interval. In other words, the model is significant, and financial markets and institutions have a substantial impact on economic development.

The research began by constructing a panel dataset spanning 1980 to 2021. A regression analysis was then conducted to test the significance of nine indexes. Although the model was significant, the variables FM, FIE, and FME were excluded due to issues with multicollinearity. Table 2 summarises the variables used in the study.

Table 2: Descriptive Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum	Number of observations / Duration (N/T)
FD	0.2548251	0.2128253	0	1	7686/42
FI	0.3375661	0.2270584	0	1	7686/42
FID	0.2027697	0.23429	0	1	7686/42
FIA	0.2653482	0.2677297	0	1	7686/42
FMD	0.1483545	0.2279143	0	1	7686/42
FMA	0.1687086	0.2421583	0	1	7686/42

All variables are indexes ranging from 0 to 1, eliminating the need for logarithmic transformation. Model assumptions were tested based on the estimation method. However, with T > 30, tests for autocorrelation, heteroskedasticity, or normality were unnecessary. For causality analysis, the panel dataset's parameters (excluding the constant) were required to be homogeneous (Tatoğlu, 2024).

To determine the stationarity of the variables in the model, unit root tests should be conducted. To decide which unit root test to use, a horizontal cross-section dependence test is performed. When measuring horizontal cross-section dependence, the test is determined by the relationship between the observation value (N) and the time dimension (T). Since N > T (N= 7686, T=42), the Pesaran test is used in this study.

Unit root tests assessed variable stationarity. A cross-sectional dependence (CSD) test determined the appropriate unit root test based on the relationship between observations (N) and time dimension (T).

CSD reflects the interrelatedness among variables, such as countries, households, firms, or income, within the model. Its presence necessitates a suitable stationarity test to avoid econometric issues.

The Pesaran, Friedman, and Frees tests measure CSD. Given N > T (N = 7686, T = 42), the Pesaran test was selected, formulated as in Equation 3 (Pesaran, 2012; De Hoyos & Sarafidis, 2006):

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right)$$

Where CD denotes cross-sectional dependence, T is the time dimension, and N is the number of observations. Pesaran's hypotheses are:

Pesaran's hypotheses are as follows:

The hypotheses for Pesaran's CSD test are as follows:

H_0: CSD does not exist.

H_1: CSD exists.

The results of these hypotheses are presented in Table 3.

Table 3: Cross-Sectional Dependence (CSD)

Pesaran's test of CSD: 25.592
Prob.: 0.000

According to Table 3, with $p < 0.05$, H0 was rejected, confirming the presence of CSD among variables, necessitating second-generation unit root tests (Tatoğlu, 2013b). As a result of the tests performed in the established model, it is found that there is horizontal cross-section dependence. Therefore, it is necessary to use the second-generation panel unit root tests to test the stationarity of the series. Pesaran's (2003) unit root test was used in the analysis.

$$Y_{it} = \alpha_i + \rho_i^* Y_{i,t-1} + d_0 \bar{Y}_{t-1} + d_1 \Delta \bar{Y}_t + \varepsilon_{it}$$

The Pesaran unit root test was performed with the hypotheses below:

H_0: A unit root exists, and the series is non-stationary.

H_1: No unit root exists, and the series is stationary.

The unit root test results based on the established hypotheses are shown in Table 4.

Table 4: Unit Root Test Results

Variables	Level		Variables	First Difference	
	Z (t-bar)	Probability		Z (t-bar)	Probability
FD	-7.357	0.000	FIA	-46.440	0.000
FI	-7.198	0.000	FMD	-39.113	0.000
FID	-1.896	0.029	FMA	-13.162	0.000

Note: The significance level was set at 5%, and the lag lengths were automatically selected by the Akaike Information Criterion (AIC).

FD, FI, and FID were stationary at level (H_0 rejected at 5%), indicating no unit root. FIA, FMD, and FMA were non-stationary at level but became stationary after first differencing.

Optimal lag value results are shown in Table 5.

Table 5: Optimal Lag Value Results

Lag Value	CD	J prob. value	MBIC	MAIC	MQIC
1	0.9999863	0.0045464*	-42.80962	1.471929	-28.75023*
2	0.999972*	0.1569661	-43.51429*	-4.873517*	-19.9846

There are five criteria for calculating the optimal lag value. These are Horizontal Cross Section Dependence (CD), Hansen's J test (J probability value), Adjusted Bayesian Information Criterion (MBIC), Adjusted Akaike Information Criterion (MAIC) and Adjusted Hannan-Quinn Information Criterion (HQIC). The minimum value in these criteria gives the optimal number of lags. Since the minimum lag is 2 in most of the lag criteria, the optimal number of lags is 2.

The study employed first-generation panel causality tests that account for common structural differences (CSD). The homogeneity or heterogeneity of the panel dataset guided test selection (Tatoğlu, 2024). Therefore, this study measures homogeneity using the delta test proposed by Pesaran and Shin (1998) and Pesaran and Smith (1998), as well as the delta test proposed by Pesaran and Yamagata (2008). The hypotheses for the delta test, whose formula is presented in the methodology section, are as follows:

H_0: The slope coefficient is homogeneous.

H_1: The slope coefficient is heterogeneous.

The results of the delta test examining these hypotheses are provided in Table 6.

Table 6: Homogeneity Test Results

Variables	Statistics	P-value
Delta	56.127	0,0826
Delta adj.	61.634	0,0953

According to the homogeneity test results in Table 5, the probability value (> 0.05) leads to the acceptance of the H_0 hypothesis, confirming that the panel dataset is homogeneous. Panel Granger causality analysis was used to test the causality relationship between the variables of the panel set, which was found to be homogeneous. The hypotheses and model of the panel Granger causality analysis, as stated in the method section, are presented below.

To test the causal relationships among the variables of the homogeneous panel dataset, panel Granger causality analysis is employed. The hypotheses for the panel Granger causality analysis, as outlined in the methodology section, are presented below:

H_1: x is not a Granger cause of y.

H_2: y is not a Granger cause of x.

According to these hypotheses, if H_1 is accepted, x is not a Granger cause of y; otherwise, it is. If H_2 is accepted, y is not a Granger cause of x; otherwise, it is. If both hypotheses are accepted, no causal relationship exists between the variables. If both hypotheses are rejected, a bilateral causal relationship is present. The model for the causality analysis, as explained by these hypotheses, is shown in Equation 5.

$$y_t = a_1 + \sum_{i=1}^{P} b_{1i}\, y_{t-i} + \sum_{i=1}^{P} b_{2i}\, X_{t-i} + v_{1t}$$

$$x_t = c_1 + \sum_{i=1}^{P} d_{1i}\, y_{t-i} + \sum_{i=1}^{P} d_{2i}\, X_{t-i} + v_{2t}$$

In Equation 5, the value of p denotes the lag lengths. Y and X represent the dependent and independent variables, respectively. In the first equation, the effect of the dependent variable Y's lags and the lags of the independent variable X on Y is observed. In this equation, a represents the constant term, while v denotes the error term. In the second equation, the effect of the independent variable X's lags and the lags of the dependent variable Y on X is demonstrated. In this equation, c represents the constant term, and v denotes the error term. In the Vector Autoregression (VAR) model, there should be no correlation between the lagged values of the error terms; however, if this assumption is violated, it can be corrected by increasing the number of lags for the variables in the model. The optimal lag lengths in the VAR model are determined using the Akaike and Schwarz information criteria. VAR analysis yields results in three ways: first, through Granger causality results obtained via the F-test; second, through variance decomposition, which reveals the dynamic interactions between variables; and third, through impulse-response functions, which provide a graphical representation of the relationship between variables (Özgen & Güloğlu, 2004).

Following the explanation of the theoretical framework of causality analysis, the results of the causality analysis conducted in this study gain significance. In the research, the variables in the model were found to be stationary, and the causality test was performed using the Wald test. The validity of the hypotheses established in the Wald test is calculated using the following formula: F = ((HKTS – HKT) / r) / (HKT / (n – k)). In this formula, HKTS represents the sum of squared errors of the restricted model, HKT denotes the sum of squared errors of the unrestricted model, r indicates the number of restrictions, n represents the number of observations, and k signifies the number of parameters. If the calculated F-value exceeds the critical F-value from the table, the H_1 and H_2 hypotheses are rejected. The results of the Granger causality test applied in this study are presented in Table 7.

Table 7: Panel Granger Causality Analysis

Variables	Chi2	df	Prob > chi2	Results
FD → FI	10.583	2	0.005*	Causality
FD → FID	13.390	2	0.001*	Causality
FD → FIA	19.924	2	0.000*	Causality
FD → FMD	36.622	2	0.000*	Causality
FD → FMA	6.767	2	0.034*	Causality
FI → FD	2.249	2	0.325	None
FI → FID	39.991	2	0.000*	Causality
FI → FIA	44.606	2	0.000*	Causality
FI → FMD	0.808	2	0.668	None
FI → FMA	2.472	2	0.290	None
FID → FD	7.435	2	0.024*	Causality
FID → FI	4.125	2	0.127	None
FID → FIA	7.615	2	0.022*	Causality
FID → FMD	7.368	2	0.025*	Causality
FID → FMA	0.448	2	0.799	None
FIA → FD	1.064	2	0.587	None
FIA → FI	19.045	2	0.000*	Causality
FIA → FID	17.890	2	0.000*	Causality
FIA → FMD	2.558	2	0.278	None
FIA → FMA	2.555	2	0.279	None
FMD → FD	1.986	2	0.370	None
FMD → FI	18.957	2	0.000*	Causality
FMD → FID	13.824	2	0.001*	Causality
FMD → FIA	8.060	2	0.018*	Causality
FMD → FMA	1.067	2	0.587	None
FMA → FD	1.424	2	0.491	None
FMA → FI	4.694	2	0.096	None
FMA → FID	1.407	2	0.495	None
FMA ↔→ FIA	0.346	2	0.841	None

Note: *: The significance level was set at 5%

The Granger causality analysis results in Table 7 are presented with a 95% confidence interval and a 5% significance level. According to the results, bidirectional relationships;

A bidirectional causality relationship was found between financial development and depth in financial institutions (FD↔FID).

Bidirectional causality is found between financial institutions and access to financial institutions (FI↔FIA).

A bidirectional causality relationship is found between access to financial institutions and depth in financial institutions (FIA↔FID).

A bidirectional causality relationship was found between depth in financial institutions and depth in financial markets (FID↔FMD).

Unidirectional relationships;

A unidirectional causality relationship was found from financial development to almost all variables, including financial institutions, access to financial institutions, depth in financial markets and access to financial markets.

A unidirectional causality relationship was found from depth in financial markets to financial institutions and access to financial institutions.

A unidirectional causality relationship was found from access to financial markets to depth in financial markets.

According to the findings, the variables of financial development, financial markets, and financial institutions are found to be integrated. Although some sub-indicators are not directly related to each other, it is revealed that financial markets and financial institutions have an impact on financial development. In the context of the literature, variables related to financial markets and financial institutions have been used as auxiliary indicators. In contrast, the effect of financial development on economic growth has been discussed in most studies. This finding also suggests that financial markets and institutions play a crucial role in supporting financial development. The findings in the literature where results such as financial institutions affect financial development (Trinugroho et al. 2021), quality financial institutions increase both growth and development (Ehigiamusoe & Samsurijan, 2020), financial institutions support financial development (Fernandez & Tamayo, 2017), inadequate financial

institutions hinder the development of the financial sector (Marcelin & Mathur, 2014), and countries with developed financial markets have good financial development levels (Fergusson, 2006), support the findings of the study.

Conclusion

The concept of financial development (FD) enables countries to assess their economic status, identifying strengths, weaknesses, and measures needed for their financial future. FD encompasses the evolution of a country's financial institutions, markets, and instruments.

This study examines the presence and nature (unilateral or bilateral) of causality among financial markets (FMs), institutions, and foreign direct investment (FDI).

The dataset comprises a panel of 183 countries spanning the period from 1980 to 2021. Initially, nine variables were included, but three were removed due to multicollinearity, leaving six: FD, FI, FIA, FID, FMD, and FMA.

Following the identification of the variables, analyses were conducted using the panel dataset employed in the study. Initially, the stationarity of the variables was examined. Unit root tests were utilised to assess stationarity. To determine which unit root test to apply, the model's cross-sectional dependence was evaluated, and it was decided that the Pesaran unit root test was appropriate. The Pesaran unit root test was used to determine the stationarity levels of the six variables, and those found to be non-stationary were transformed into stationary series. After the variables were rendered stationary, a homogeneity test was conducted to determine the appropriate test for examining the causal relationships between the variables in the model—the primary objective of the study. Upon establishing that the panel dataset was homogeneous, the causality analysis was performed using the Panel Granger Causality Test, and the resulting findings were evaluated.

In the study's findings, the analysis of cross-sectional dependence—conducted to decide which unit root test to use—revealed the presence of cross-sectional dependence among the model's variables. Consequently, it was determined that the Pesaran unit root test, a second-generation unit root test, should be employed. According to the Pesaran unit root test, the variables FD, FI, and FID were found to be stationary at level. In contrast, the variables FIA, FMD, and FMA were stationary at their first differences. After all variables were made stationary, a homogeneity test was conducted to proceed with the causality analysis aligned with the study's objective. Based on the panel Granger causality test, both findings of unilateral and bilateral causalities were identified among several variables. These results indicate that each of the variables—financial development, financial markets, and financial institutions—serves as a cause of the others and can explain them. This finding demonstrates that financial markets, financial institutions, and financial development are interconnected. This integration suggests that a change in one variable could positively or negatively affect the others, as they are causally linked.

These results suggest that improving financial development (FD) requires countries to prioritise their financial management (FMs) and institutions while ensuring the monetary system operates effectively and cohesively. Such integration is vital for sustainable economic development (FD), a recommendation supported by the outcomes of this study.

In light of all the findings, the study emphasises that countries worldwide should prioritise their financial markets and institutions to enhance their financial development. It is crucial to utilise financial systems effectively and efficiently, encompassing all these variables. This efficiency is achieved through the harmony and integration among all these variables that constitute the financial system. With harmonisation and integration, it will be easier for countries to enhance their financial development. Otherwise, it will not be sustainable, and a temporary success will be achieved. Sustainable financial development is the result of the systematic and harmonised operation of all variables that comprise the financial system. The findings of this study confirm this suggestion. For future studies, suggestions such as increasing the data set, employing different econometric methods, dividing the sample into classes using a clustering method, developing new econometric models to reveal differences between countries, or examining a single country sample with time series analysis can be considered.

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