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The Impact of Financial Inclusion Shocks on Financial Cycles with Emphasis on Financial Stability: A Panel-VAR Approach

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ABSTRACT

This study aims to examine the impact of financial inclusion shocks on financial cycles, emphasizing financial stability in 73 developing and developed countries over the period 2005-2020. Impulse response functions and Granger causality in the form of a Panel Vector Autoregression (PVAR) have been investigated to analyze the models. At first, the results show that low-level financial inclusion initially reduces financial and credit cycles, but after increasing the financial inclusion level, this negative effect becomes positive and improves financial cycles. Additionally, financial stability can improve financial cycles. Finally, a positive shock from both indicators of the financial cycle increases the variable itself, and the effect of this shock is decreasing. Moreover, the Granger causality test results show a two-way causal relationship between the financial cycle and financial inclusion in both models. Both models show a two-way causal relationship between the financial cycle and financial stability. There is also a one-way causal relationship from financial stability to the financial cycle and financial stability variables. In other words, it can be argued that the variables of the financial cycle, financial inclusion, and financial stability are the Granger causality of each other in the selected countries.

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1. Introduction

In recent decades, strengthening and developing financial inclusion has become one of the priorities of policymakers and senior managers in Islamic countries. The reason for this is that the development of financial inclusion provides access to financing services for all income groups (including the poor), and this can provide the basis for strengthening the economic growth of countries and increasing the economic welfare of the general public in the medium and long term. Furthermore, financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs-transactions, payments, savings, credit, and insurance-delivered responsibly and sustainably (Yin et al., 2019).

Achieving a higher level of fiscal inclusion leads to the development and stability of countries' financial systems. Therefore, under "well-designed fiscal policies" (Dema, 2015), sharp increases in fiscal inclusion may lead to a win-win situation in countries regarding growth and stability (Rahman, 2014; López and Winkler, 2019). Ignoring the relationship between financial inclusion and stability may lead to costly financial crises or continued financial deprivation. Central bankers and other policymakers are interested in promoting financial inclusion and stability in trade-offs and synergies. In general, policymakers have public duties and responsibilities regarding financial stability (Čihák et al., 2012; Čihák et al., 2016).

López and Winkler (2019) showed that countries with a higher level of financial inclusion or more substantial progress in financial inclusion in the pre-crisis period yield a benefit in the form of a less pronounced drop in credit growth, controlling for the size of the pre-crisis credit boom (López and Winkler, 2019). These findings are consistent with the previous literature on the relationship between financial inclusion and financial stability, indicating a positive relationship between financial stability and financial inclusion. A higher level of development of fiscal inclusion in the pre-crisis period does not reduce the drop in credit growth during a financial crisis, given the developments in pre-crisis

credit growth. Thus, if a crisis occurs, the rapid growth of the borrower before the crisis will not help the dampening boom-bust cycles.

In general, a high degree of financial inclusion and prosperity would dampen the financial cycle in a crisis, but the growth rate of borrowers in a pre-crisis period at the time of turmoil and financial crisis does not affect credit developments. Thus, having a higher level of financial inclusion increases potential economic growth, reduces poverty, and improves credit boom-bust cycles in crisis times.

We contribute to this literature by testing whether financial inclusion mitigates credit boom-bust cycles characterizing financial crises (Schularick and Taylor, 2012; Shobande and Lanre, 2018; López and Winkler, 2019). Awareness of this issue and its extent is of great importance for planners and policymakers. Given that none of the studies has examined The Impact of Financial Inclusion Shocks on Financial Cycles with Emphasis on Financial Stability in developing and developed countries; therefore, how financial inclusion affects financial cycles requires empirical study. In this regard, the present study examines the impact of financial inclusion on financial cycles, emphasizing financial stability using panel data over the period 2005-2020.

2. Literature Review

2.1 Financial Inclusion and Credit Boom-Bust Cycles

In experimental studies, Prasad (2010), Han and Melecky (2013), and Said et al. (2019) had stated that financial inclusion could improve financial intermediation efficiency by increasing both savings and the amount and value of transactions, improving investment cycles. The increased intermediation of domestic savings and the greater access to bank deposits boost the resilience of the deposit funding base of the banking sector, particularly in times of stress, which occurs by lowering the likelihood of correlated deposit withdrawals. Financial inclusion also improves banking sector liquidity (due to increased deposits) and lowers liquidity risks.

Hannig and Jansen (2010) argued that low-income groups in the financial sector that tend to increase the stability of deposit and lending

bases are relatively safe from economic cycles. According to them, financial institutions that support low prices are well affected by major crises and contribute to the stability of economic activities.

Gimet and Lagoarde-Segot (2012) explained that financial development, as evidenced by more developed stock markets, increases finance access because it provides opportunities for banks to develop tools to increase access to their supply and services. They also found that a larger banking sector size hinders access to finance, and smaller banks with intense proximity to their clients are better for financial inclusion. The health and efficiency of the banking sector are hugely important in terms of access to finance, particularly lower non-performing loans (NPLs) and higher bank capital to asset ratio, and lower fees on deposit accounts. It was also found that institutional quality determines access to finance. They found that an increase in Tier 1 bank capital asset ratio had a negative impact on credit, which implied that while higher capital requirements were effective in lowering credit boom-related vulnerabilities, lower credit expansion meant lower financial inclusion. Bartoletto et al. (2019) investigated the effect of credit fluctuations on business and credit cycles using the autoregressive vector threshold model (TVAR) over the period 1861-2013. Evidence suggested that boom and bust cycles are longer and more stable than business cycles. The results also showed that medium-term cycles account for the largest share of Italian credit cycle fluctuations. Credit and business cycles are weakly synchronized in the medium term, while these cycles move smoothly in the short run when the GDP cycle leads to the bank credit cycle.

Also, Ozili (2021) Using the sample period includes 2011, 2014 and 2017 in G20 countries states the level of savings and the number of active formal account ownership are pro-cyclical with fluctuations in the business cycle. Also, savings by adults particularly for women and poor people declines during recessionary periods while the number of active formal account ownership declines for the adult population especially for women during recessionary periods. Also the results reveal that not all

indicators of financial inclusion are pro-cyclical with fluctuating business cycles.

2.2 Financial Inclusion, Financial Stability, and Financial Cycles

Recently, fiscal inclusion has become one of the main goals of central banks in developing countries. Evidence suggests that financial inclusion can increase the welfare of households by enabling access to financial products by disadvantaged groups. The formality in accounts ownership and saving tends to cultivate benefits both to the nation and individuals at the micro-level. However, assessing the consequences of financial inclusion on the soundness of the bank has received less attention. Researchers believe that poverty in developing countries is the result of financial exclusion. Although financial inclusion is essential to facilitating access to basic financial services, stability in the banking sector is a prerequisite Sakarombe, 2018).

Morgan and Pontines (2014; 2017) stated that increasing the share of lending to small and medium-sized enterprises contributes to financial stability and improved financial cycles by reducing non-performing loans (NPLs) and the probability of default by financial institutions. Also, Hawkins Studies (2006), Han and Melecky (2013), and Siddik and Kabiraj (2018) asserted that financial inclusion could directly increase financial stability, and Claessens (2006) declared that financial inclusion indirectly increases financial stability, and thus improves financial cycles. Besides, using the Generalized Method of Moment (GMM), Sakarombe (2018) stated that financial inclusion could increase the stability of the banking sector. Using the financial data of 5 banks and the test of classical hypotheses over the period 2011-2016, Widarwati et al. (2019) explained that deposits as a representative of financial inclusion have a positive effect on financial stability.

2.3 Theoretical Background

In this regard, many studies have been conducted outside the state, some of which are briefly discussed in this section. The study conducted by Aduda and Kalunda (2012) is consistent with the study by Morgan and Pointes (2014), they suggested that the Kenyan government intensify its

strategies to increase financial inclusion, which could be done through financial intermediaries that provide services to low-income people consistent in their spending and consumption behavior. This compatibility makes them safe from the economic cycle. Therefore, their financial inclusion in the system ensures stability in the deposit and lending bases of financial institutions, which leads to a stable financial system.

Morgan and Zhang (2015) examined the relationship between financial inclusion and financial stability using the ordinary least squares (OLS) method and the Generalized Method of Moment (GMM) in 19 emerging countries over the period 2007-2013. To do this, they used the quadratic function of mortgage lending to test the potential nonlinear relationship between financial inclusion and financial stability. The results show that financial inclusion increases financial stability by reducing the probability of non-payment by financial institutions and reducing the ratio of non-current receivables, at least, in non-crisis periods for the mortgage loan ratio levels. For high levels of mortgage ratios, this effect also has a negative effect on financial stability.

Similarly, Cihak et al. (2016) provided evidence for a trade-off relation between financial stability and financial inclusion. The degree of this cooperation ratio depends not only on the indicators for measuring financial stability and financial inclusion but also on the covariance of their estimates. Without crises, financial inclusion tends to correlate positively with financial stability.

In the same vein, using an international sample of 2635 banks in 86 countries over the period 2004-2012, Ahamed and Mallick (2019) concluded that high financial inclusion levels increase banking stability. This positive relationship has been particularly pronounced for banks with a high share of the customer deposit budget and low margin costs for providing financial services and operating with more substantial institutional quality. These results showed that the importance of ensuring a comprehensive financial system is a development goal, an

issue that should be a priority for banks because such a stimulus policy is better for the stability of banks.

In another paper conducted by Vo et al. (2019), the relationship between financial inclusion and macroeconomic stability is examined using a Panel threshold estimation technique over the period 2008-2015 in 22 emerging countries. The study results showed that financial inclusion under a certain threshold increases financial stability, and financial inclusion leads to sustainable production growth and inflation.

Using Structural Equation Modelling (SEM) over the period 2004-2017, Atellu et al. (2019) investigated the relationship between financial inclusion and financial stability. The results indicated that access and use of financial services in Kenya would strengthen financial stability. According to them, financial inclusion and increased access to financial services have a positive effect on financial stability.

López and Winkler (2019) investigated the role of financial inclusion in credit cycles, emphasizing financial stability using estimates of the pooled OLS regressions over the period 2004-2017. The study results indicated that countries with high financial inclusion show lower pronounced credit busts in times of financial turmoil. However, higher borrower growth rates in the pre-crisis years have no diminishing effect on the depth of the recession. In their view, this is a policy challenge to expand financial inclusion without the participation of a potentially destabilizing credit boom.

A review of the studies shows that in none of the studies the relationship between the three variables of financial inclusion, financial stability and financial cycle has been considered using the PVAR model, so this study aims to examine the Impact of Financial Inclusion Shocks on Financial Cycles with Emphasis on Financial Stability during the period 2005-2020 using the PVAR model in developing and developed countries, which we will introduce in the panel autoregression vector (PVAR) model.

3. Methodology and Data

3.1 Panel Vector Autoregressive Model

To investigate the response of financial cycles to shocks of financial inclusion and financial stability, the analysis of the Impulse Response Function from the technique combines the traditional VAR approach, which treats all system variables as endogenous, with the panel-data approach, which allows for unobserved individual heterogeneity. Love and Ziccino introduced this approach in 2006 as an alternative to macro metric models.

The Panel VAR model is based on the empirical relationships between panel data and is considered a summary form of a simultaneous equations system, each of the endogenous variables is regressed on its lags and the lags of other variables in the system. This method can express the dynamic structure of the model and remove the constraints that are often associated with economic theories. In the Panel VAR approach, the data are placed in the estimation process after the Helmert Transformation, thus eliminating the fixed effects (Holtz et al., 1988; Love and Ziccino, 2006).

In this model, it is not necessary to specify short-term structural relationships with structural knowledge of the causal relationships between model variables. In particular, reliance on the Panel VAR approach is inevitable when there is no accurate information on how the real-world process works or the determinants of pattern variables. In this approach, the theory and prior knowledge of the researcher are used only to determine the variables that should be included in the model. These unconstrained autoregressive models, introduced and developed by Sims (1972; 1980), were initially known as non-theoretical patterns. Nevertheless, this approach was challenged in later years by several economists, including Sims himself. The main problem began with the fact that Cholesky decomposition is the order of the variables of the sensitive device as a method to identify structural shocks in unconstrained autoregression devices. Cholesky decomposition imposes a

special recursive structure on the model. Additionally, the order of variables usually varies based on Economic different views.

Except where the structural model can be identified from the summarized form of autoregressive, in other cases, the error terms Cholesky decomposition does not have a direct economic interpretation (Mehrara and Nikki Oskooi, 2006).

This method can express the dynamic structure of the model and remove the constraints that are often associated with economic theories. This method is a linear relationship between the dependent variable and the lags of all variables in the equations system, and the number of lags is determined according to the general criteria of model selection. The equation is the general expression of a Panel VAR system with n dependent variables (n equations):

$$\begin{bmatrix} Y_{1it} \\ Y_{2it} \\ . \\ . \\ . \\ Y_{nit} \end{bmatrix} = \begin{bmatrix} C_{1i} \\ C_{2i} \\ . \\ . \\ . \\ C_{ni} \end{bmatrix} + \begin{bmatrix} A_{11}(L)A_{12}(L).....A_{1n}(L) \\ A_{21}(L)A_{22}(L).....A_{2n}(L) \\ . \\ . \\ . \\ A_{n1}(L)A_{n2}(L).....A_{nn}(L) \end{bmatrix} \begin{bmatrix} Y_{1it} \\ Y_{2it} \\ . \\ . \\ . \\ Y_{nit} \end{bmatrix} + \begin{bmatrix} u_{1it} \\ u_{2it} \\ . \\ . \\ . \\ u_{nit} \end{bmatrix} \quad (1)$$

or in the form of:

$$Y_{it} = C_i + A(L)Y_{it} + u_{it} \quad (2)$$

where Y_{it} is the variable vector in the equations system $C_i (i = 1, \dots, n)$ is the intercept of the equations, A is matrix n * n of the pattern coefficients, and (L) indicates the Lag Operator. u_{it} is a random error term assumed to have a normal distribution with a mean of zero and a constant variance Matrix elements are defined as follows:

$$A_{ij}(L) = \sum_{K=1}^{K} L^K a_{ijk} \quad (3)$$

where i, j, and k represent the number of the equation, the number of the variable in the equation, and the number of lags for the model, respectively.

3.2 Data

The present study examines the impact of financial inclination shocks on financial cycles, emphasizing financial stability in 73 developing and

developed countries over the period 2005-2020. The Impulse Response Function, Granger causality, and Variance Decomposition in the form of Panel Vector Autoregressive (PVAR) model have been investigated to evaluate the model and results. The general model follows the study model of López and Winkler (2019) as follows [4]:

$$\text{DCREDIT1}_{it} = f(LNCLUTION_{it}, ZSCORE_{it}) \quad (4)$$

$$\text{DCREDIT2}_{it} = f(LNCLUTION_{it}, ZSCORE_{it}) \quad (5)$$

DCREDIT_{it}: The financial cycle index, which has been used from the credit to GDP ratio, following the studies of Keshtgar et al. (2019). For this purpose, the fiscal cycle, the ratio of credit to GDP is calculated. Additionally, its deviation from the long-term ratio of credit to GDP is considered various ways to analyze data observed trend and volatility that exists in this study, two models: 1) DCREDIT1_{it}: The difference of the Domestic credit to private sector (% of GDP) 2) DCREDIT2_{it}: The difference of the Domestic credit to private sector by banks (% of GDP) has been used as indicators of the financial cycle in two models.

$\text{INCLUSION}_{\text{it}}$: The principal component analysis method (PCA) has been used to obtain the financial inclusion index ($LNCLUTION_{it}$) following the study of Shobande and Lanre (2018).

This study follows the studies of Goel and Sharma (2017), Neaime and Gaysset (2018) used two indicators: Number of ATMs per 100,000 adults (ATM) and Number of commercial bank branches per 100,000 adults (NCBB):

$$INCLUSION = \sum_{i=1}^{2} a_{ij} X_{ij} \quad (6)$$

where INCLUSION is the composite index of the financial inclusion index development, X_{ij} is i_{th} variable in j_{th} year, and a_{ij} is factor load as derived by PCA. Thus INCLUSION captures the two indicators as mentioned above and which are summarized in Table 1.

Table 1. Results of Principal Component Analysis for Financial Inclusion Index (INCLUSION)

Eigenvalues (sum=2 , Average=1)					
Number	**Value**	**Difference**	**Proportion**	**Cumulative Value**	**Cumulative Proportion variance**
1	1.528744	1.057487	0.7644	1.528744	0.7644
2	0.471256	-	0.2356	2.000000	1.0000

Eigenvalues (sum=2 , Average=1)					
Number	**Value**	**Difference**	**Proportion**	**Cumulative Value**	**Cumulative Proportion variance**
Eigenvectors (loadings)					
Variable		PC1		PC2	
ATM		0.707107		-0.707107	
NCBB		0.707107		0.707107	
Ordinary correlations					
		ATM		NCBB	
ATM		1.000000		-	
NCBB		0.528744		1.000000	

Source: Research finding.

The results of Table 1 show that the value of the Eigenvalues for the first factor is equal to 1.537025. Since the Cumulative Proportion variance by the Eigenvectors is obtained by dividing the first factor by 2 (number of financial inclusion indicators), the ratio of the variance that can be estimated by the first factor is 0.7644, shown in the proportion column. The criterion of Proportion variance is one of the most important criteria for determining the number of factors. According to the information in the table, it is observed that only the first factor has particular values higher than one and explains a total of 76.44% of the total variances of the two variables. The Scree Plot related to the factors in this study is plotted as Figure 1.

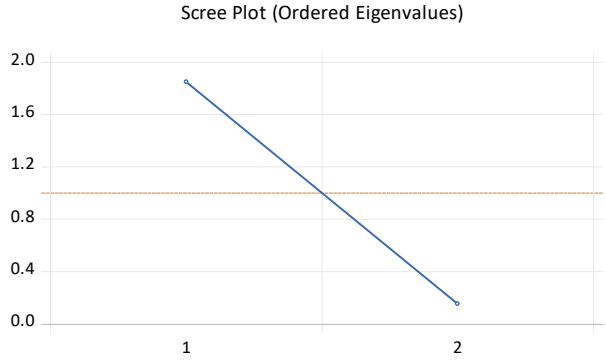

Figure 1. Eigenvalues of Principal Components
Source: Research finding.

$STABLITY_{it}$: Examples of data on financial stability include:

- Bank Z-scores (an indicator of the probability of default of the country's banking system)
- The ratio of non-performing loans (NPLs)

- The ratio of bank credit to bank deposits, the ratio of bank regulatory capital to risk-weighted assets
- The ratio of bank liquid assets to deposits and short-term funding

In this study, the bank Z-score index has been used to estimate the financial stability index. The Z-score index was used to evaluate the banking financial stability variable following the studies of Houston et al. (2010), Turk Ariss (2010), Fang et al. (2014), Han and Melecky (2013), Creel et al. (2015), Cihak et al. (2016), Vo et al. (2018), and López and Winkler (2019). This index is calculated as follows:

$$z - score = \frac{ROA_t + {}^{Eq}/_{T_A}}{\sigma(ROA)_t} \quad (7)$$

This study examines the impact of financial inclusion shocks on the financial cycle, emphasizing financial stability in 73 developed and developing countries. These statistics and data variables are used on an annual basis of parameters set by World Development Indicators (WDI), International Monetary Fund (IMF), and Financial Access Survey (FAS) over the period 2005-2020.

4. Empirical Finding

4.1 Panel Unit Root Test

The composite regarding the indicators of financial development have been constructed through the use of PCA (Principal Component Analysis). The technique serve as a statistical method that is used in constructing single weighted form of index from different but correlated form of variables. In order to take into account different financial development aspect the study use PCA in constructing the complete indices for the variables. PCA is capable of condensing large set of enormously correlated variables into a summarized set of indicators that are correlated which describe a considerable disparities of the original form of data set (Katircioğlu and Taşpinar, 2017).

Table 2. Principal Component Analysis for Financial Development Index

Component	Eigenvalue	Difference	Proportion	Cumulative
1	2.91526	2.02811	0.5831	0.5831
2	0.887146	0.161026	0.1774	0.7605
3	0.726121	0.291608	0.1452	0.9057

Component	Eigenvalue	Difference	Proportion	Cumulative
4	0.434513	0.397551	0.0869	0.9926
5	0 .036962		0.0074	1.0000

Source: Research finding.

Based on the criteria of Kaiser (1974), the study dropped the form of components that have a less than one eigenvalue and reserved those one that have above one. As revealed in Table 2, Component 1 possess highest share of the variance, while the other components emanate with increasingly lesser share of the remaining variance. Therefore, the first component is hold on the basis of the analysis, this described 58.3% of the variance.

4.2 Unit Root Test

If a series is non-stationary, it may lead to erroneous results before using them for further analysis. For this purpose, this study employs one statistical method to test the stationary and non-stationary conditions, that it is Phillips-Perron (PP) test. A summary of the test results is presented in Table 2. According to the results, all variables are stationary in levels and Significance at the 1% level.

Table 2. Panel Unit Root Tests at Level

Phillips-Perron (PP) test				**Variables**
29.916	Modified inv. chi-squared	657.210	Inverse chi-squared	**DCREDIT1**
0.000	Prob	0.000	Prob	
25.336	Modified inv. chi-squared	578.957	Inverse chi-squared	**DCREDIT2**
0.000	Prob	0.000	Prob	
6.574	Modified inv. chi-squared	258.336	Inverse chi-squared	**INCLUSION**
0.000	Prob	0.000	Prob	
7.469	Modified inv. chi-squared	273.631	Inverse chi-squared	**ZSCORE**
0.000	Prob	0.000	Prob	

Source: Research finding.

4.2 Estimation of PVAR Model

4.2.1 Optimal Lag Selection

The second step in the PVAR method is to choose the optimal lag order in the panel VAR specification (Table 3). Andrews and Lu (2001) proposed consistent moment and model selection criteria (MMSC) for GMM models based on Hansen's (1982) J statistic of overidentifying restrictions. Their proposed MMSC is analogous to the various commonly used maximum likelihood-based model selection criteria,

namely the Akaike information criteria (AIC) (Akaike, 1969), the Bayesian information criteria (BIC), and the Hannan-Quinn information criteria (HQIC). Based on the three model selection criteria by Andrews and Lu (2001) and the overall coefficient of determination, first-order panel VAR is the preferred model because this has the smallest MBIC, MAIC, and MQIC. However, the overall coefficient of determination suggests applying a model with 1 lag in the two models.

Table 3. Results of Optimal Lag Selection

The first model					
Lag	J	J Pvalue	MBIC	MAIC	MQIC
1	28.69352	0.3759153	-148.4543	-25.30648	-72.88845
2	27.40894	0.0716383	-90.68961	-8.591062	-43.31238
3	9.762295	0.3700694	-49.28698	-8.237705	-24.09836
The second model					
Lag	J	J Pvalue	MBIC	MAIC	MQIC
1	29.63004	0.3310307	-147.746	-24.36996	-72.02145
2	27.14895	0.0762438	-91.10171	-8.851048	-40.6187
3	10.25705	0.3300795	-48.86829	-7.742952	-23.62678

Source: Research finding.

4.2.2 Panel VAR Model Estimation

The coefficients of the system given after the fixed effects have been estimated, and the country-time dummy variables have been removed. The model results with variables are presented in Table 4:

Table 4. Results of Model Estimation

The first model						**Dependent variable** / **Independent Variable**
ZSCORE		INCLUSION		DCREDIT1		
-0.016	Coefficient	0.074	Coefficient	0.208	Coefficient	**DCREDIT1(-1)**
0.135	Stat	0.023	Stat	0.004	Stat	
0.022	Coefficient	0.840	Coefficient	-0.240	Coefficient	**INCLUSION(-1)**
0.130	Stat	0.000	Stat	0.000	Stat	
0.989	Coefficient	-1.011	Coefficient	0.715	Coefficient	**ZSCORE(-1)**
0.000	Stat	0.000	Stat	0.003	Stat	
The second model						**Dependent variable** / **Independent Variable**
ZSCORE		INCLUSION		DCREDIT2		
-0.017	Coefficient	0.102	Coefficient	0.269	Coefficient	**DCREDIT1(-1)**
0.000	Stat	0.003	Stat	0.000	Stat	
0.024	Coefficient	0.837	Coefficient	-0.210	Coefficient	**INCLUSION(-1)**
0.074	Stat	0.000	Stat	0.000	Stat	
0.985	Coefficient	-1.055	Coefficient	0.829	Coefficient	**ZSCORE(-1)**
0.000	Stat	0.000	Stat	0.000	Stat	

Source: Research finding.

In this study, the financial cycle variables, financial inclusion, and financial stability have been regressed on the first log of the variable and other variables, the results of which can be seen in Table 4. In Panel

VAR models, the estimated values are not interpretable, and only the estimation results are used in other applications of this method, including the Granger causality test between variables, impulse response functions, and variance decompositions.

4.2.3 Model Stability Test

The stability of the PVAR was checked and confirmed since the eigenvalues are strictly less than 1 (Table 5).

Table 5. Eigenvalue Stability Condition

The first model		
Eigenvalue		Modulus
Real	Imaginary	
0.8961286	0.145935-	0.9079336
0.8961286	0.145935	0.9079336
0.2462479	0	0.2462479
The second model		
Eigenvalue		Modulus
Real	Imaginary	
0.8843964	0.1548556	0.8978515
0.8843964	0.1548556-	0.8978515
0.3241167	0	0.3241167

Source: Research finding.

Given that the eigenvalues of this model are less than one and the root of the companion matrix is inside the circle for the first model of Figure 2 and the second model of Figure3 show that none of the roots are outside of the unit circle, indicating that the PVAR model is stable and variables are stationary.

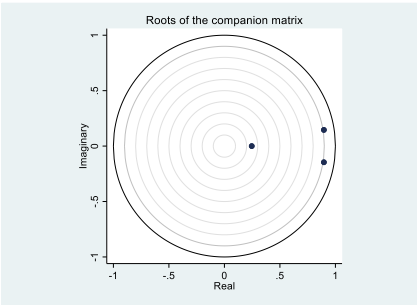

Figure 2. Roots of the Companion Matrix in the First Model
Source: Research finding.

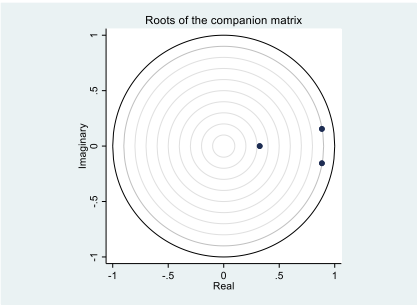

Figure 3. Roots of the Companion Matrix in the Second Model
Source: Research finding.

4.2.4 The Causal Relationship between Variables

One of the tests to examine the causal relationship between variables is the Granger causality test. Based on this test, to investigate the existence of a causal relationship between two variables, hypothesis is tested in which the rejection of the null hypothesis means the existence of a Granger causal relationship. In Table 6 the causality test results related to all variables relative to each other are reported in two models.

Table 6. Results of Two-Way Granger Causality Test

The first model				The second model			
Dependent variable	Independent variable	Stat	Prob	Dependent variable	Independent variable	Stat	Prob
DCREDIT 1	INCLUSION	22.139	0.000	DCREDIT2	INCLUSION	24.168	0.000
	ZSCORE	8.727	0.003		ZSCORE	13.136	0.000
	All	36.219	0.000		All	49.718	0.000
INCLUSION	DCREDIT1	5.158	0.023	INCLUSION	DCREDIT2	8.819	0.003
	ZSCORE	25.059	0.001		ZSCORE	29.517	0.000
	All	35.255	0.000		All	47.704	0.000
ZSCORE	DCREDIT1	2.235	0.135	ZSCORE	DCREDIT2	1.881	0.170
	INCLUSION	2.289	0.130		INCLUSION	3.062	0.074
	All	5.882	0.053		All	45.892	0.040

Source: Research finding.

The Granger causality test results also show that there is a two-way causal relationship between the financial cycle and financial inclusion in both models. Furthermore, both models show a one-way causal relationship from financial stability to the financial cycle. There is also a two-way causal relationship between the financial inclusion and financial stability variables. In other words, it can be argued that the variables of the financial cycle, financial inclusion, and financial stability are the Granger causality of each other in the countries studied.

4.2.5 Analysis of Impulse Response Functions

One of the Panel VAR pattern applications is to study the response of pattern variables to the shocks generated in each variable. The dynamics of the interactions of variables are evaluated through a Panel Vector Autoregression (PVAR) to investigate the relationship between financial cycle and financial inclusion. Therefore, the effect of a particular shock on the variable is examined, and it is shown that if a sudden change (shock) occurs in a variable, what will be the effect on the variable itself

and other variables during different periods? (Enders, 2009). The impulse response functions are shown in Figure 4 for the first model and in Figure 5 for the second model.

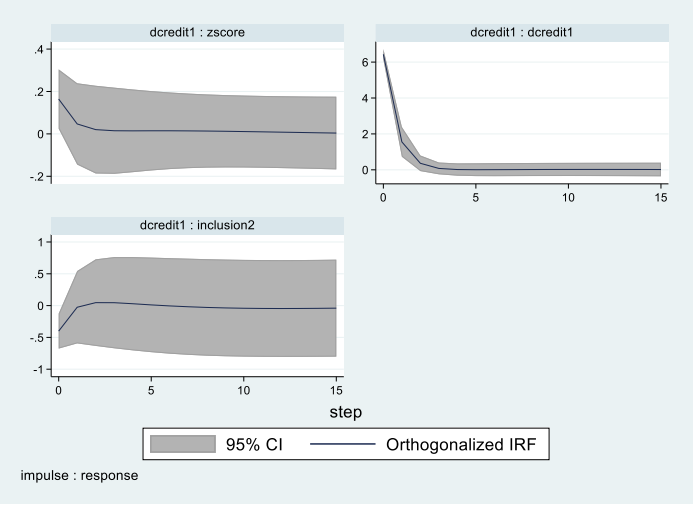

Figure 2. Impulse Response Functions in First Model
Source: Research finding.

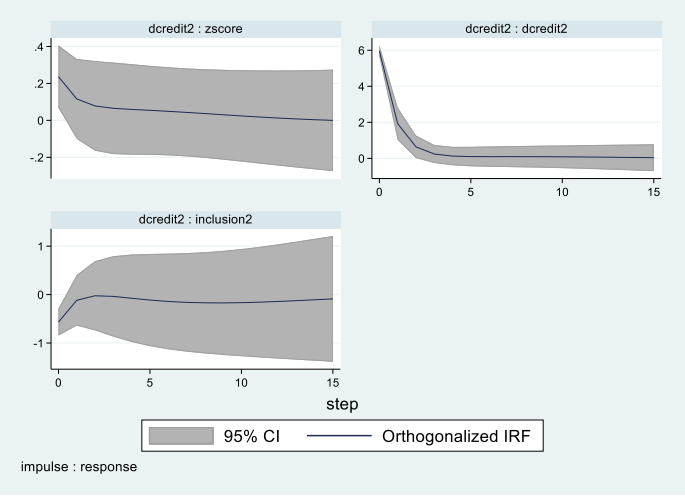

Figure 3. Impulse Response Functions in Second Model
Source: Research finding.

Figures 4 and 5 show the impulse response functions of the financial cycle variable (with two different variables) in the two models against the shocks the size of a standard deviation from the pattern variables. In this figure, the middle lines represent the impulse response functions of the financial cycle variable up to 15 periods, and the upper and lower lines represent the positive and negative boundaries for the standard deviation of the impulse response functions at the level of 5%.

In figures 4 and 5, the left and bottom chart, respectively, shows the response (dcredit1) of the first indicator of the financial cycle (the difference Domestic credit provided by the financial sector (% of GDP)) to the financial inclusion shocks in the first model and the response (dcredit2) of the second indicator the financial cycle (the difference Domestic credit to the private sector (% of GDP)) to the financial inclusion shocks in the second model over 15 periods show that at first, low-grade financial inclusion reduces financial and credit cycles. However, after increasing financial inclusion, this negative effect becomes positive and improves financial cycles. With the increasing number of ATMs per 100,000 adults and the number of commercial bank branches per 100,000 adults, financial access has increased, improving the investment cycle by increasing financial efficiency and productivity due to increased savings and the amount and value of transactions. It reduces financial crises and increases the stability and progress of financial cycles, thus improving economic growth. The results are consistent with theoretical expectations. It can be said that financial inclusion and electronic banking provide better and faster services to customers by using electronic facilities and tools. Therefore, it will be possible to provide information and provide services in less time, at a lower cost, and on a larger scale.

In Figures 4 and 5, the left and top chart, the effect of financial stability shock (Z-score) on the two indicators of financial cycles in the two models over 15 periods indicates that a stable financial system leads to better resource allocation, equipping the savings sector, reducing risk, and facilitating transactions. This stable financial system acts as a

facilitator in the economy to ensure the optimal allocation of resources, the emergence of innovative companies, and achieve efficiency, thus improving economic performance and financial cycles. These results are also consistent with theoretical expectations.

In Figures 4 and 5, the right and top chart, a positive shock from both financial cycle indicators causes the variable itself to increase. According to the above charts, the effect of this shock has a decreasing trend. Increasing and improving the financial cycle in the previous year will increase and improve the financial cycle in the current year, but this positive effect decreases.

4.2.6 Variance Decomposition

The Variance Decomposition method measures the error predicting the relative strength of the Granger causality chain or the degree of exogenous variables beyond the sample. The purpose of calculating Variance Decomposition is to determine the relative contribution and significance of an impulse caused by a variable in its changes to the changes of other variables. The shocks in the Vector Autoregression model, organized using Cholesky decomposition, indicate that any variable that appears earlier in the model will be more exogenous, and the rest of the variables will be more endogenous. The results of Variance Decomposition are presented in Table 7.

Table 7. Variance Decomposition of Pattern Variables for 10-Year Period

First model			
ZSCORE	INCLUSION	DCREDIT1	**Independent variable** / **Dependent variable**
0.5846	0.0969	0.3183	**DCREDIT1**
0.7703	0.2292	0.0004	**INCLUSION**
0.9580	0.0408	0.0010	**ZSCORE**
Second model			
ZSCORE	INCLUSION	DCREDIT2	**Independent variable** / **Dependent variable**
0.625	0.088	0.285	**DCREDIT2**
0.761	0.236	0.001	**INCLUSION**
0.955	0.040	0.003	**ZSCORE**

Source: Research finding.

The results of Table 7 of the first model show that in the long run (15-year period), about 31.83% of the fluctuations of the first index of the

financial cycle are explained by the shocks related to the financial cycle itself. Shocks also explain about Less than 1% of the fluctuations of this variable due to financial inclusion, and financial stability shocks explain Less than 1% of financial cycle fluctuations.

Moreover, the second model results show that in the long run (15-year period), about 28.5% of the fluctuations of the second index of the financial cycle are explained by the shocks related to the financial cycle itself. Shocks also explain Less than 1% of the fluctuations of this variable due to financial inclusion, and financial stability shocks also explain Less than 1% of financial cycle fluctuations.

6. Conclusion

In this study, following the study of López and Winkler (2019), using the PVAR method, the effect of financial inclusion on the financial cycle over the period 2005-2020 in 73 developing and developed countries were analyzed. The results of estimating the PVAR model and analyzing the functions of instantaneous reaction and Variance Decomposition over 15 periods show that increasing financial inclusion and financial access can improve the investment and financial cycle by increasing financial efficiency via increasing savings and the amount and value of transactions. Financial inclusion also increases the liquidity of the banking sector and reduces liquidity risks, all of which improve the balance sheets of households, firms, businesses, and the banking sector. Finally, it leads to the flourishing and development of financial cycles and thus leads to economic growth.

Financial stability has several functions, such as deepening and expanding the financial system to increase investment opportunities and attract foreign investment, expanding the banking system and non-bank financial institutions, increasing the security of the financial system and economic stability of citizens, and increasing speed and security and efficiency of financial flow. The effect of positive shock of the financial stability on the two indicators of the financial cycles in the two models over 15 periods shows that financial stability can lead to the development of large and medium industries. As a result, increasing employment and

eventually increasing exports will improve financial cycles and economic performance. Finally, a positive shock from both indicators of the financial cycle increases the variable itself, and the effect of the shocks decreases.

The Granger causality test results in both models show a two-way causality relationship between financial cycle and financial inclusion. There is also a one-way causal relationship from financial stability to the financial cycle and a two-way causality relationship between financial inclusion and financial stability in both models. In other words, it can be argued that the variables of the financial cycle, financial inclusion, and financial stability are the causal factors of each other in the studied countries. That results this study is consistent with the studies Morgan and Pointes (2014; 2015) and Morgan et al. (2019).

Based on the model estimation results, the essential policy recommendation of the study is that due to the importance of financial inclusion in improving financial cycles and financial stability, conditions should be provided to increase financial access and financial inclusion. Therefore, it is suggested that increasing financial inclusion be done through the formulation of policies to reduce the capital adequacy requirement in financial institutions and other constraints that limit the performance and efficiency of financial institutions.

Moreover, the Financial Inclusion Improvement Institute should be established under the guidance of the Central Bank to perform some measures of the public sector and coordinate to do another sector, and on the other hand, mediate the cooperation of the private sector in expanding financial services.

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