

## The Statistical effect of Financial Inclusion on economic growth-Dynamic panel data analysis during the period (2010-2021)-

الأثر الإحصائي للشمول المالي على النمو الاقتصادي-التحليل الديناميكي لبيانات البانل خلال الفترة  
- (2021-2010)

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### Abstract:

This research paper aims to statistically study the impact of financial inclusion on economic growth in selected developed and developing countries according to the data availability over the period (2010- 2021). By constructing a multidimensional financial inclusion index, using SARMA methodology for each country and applying the dynamic panel regression model based on the system GMM for the short and long run regression. The results shows that financial inclusion index negatively and significantly influence economic growth in the short run regression in developed countries and positively influence economic growth in the long run regression. While it has a positive, significant impact on economic growth in the short run in developing countries and negative in long run. The findings reveals that the impact of financial inclusion on economic growth vary from country to other due to the variation of social and economic factors.

**Key words:** : *Financial inclusion, economic growth, Panel data, SYS-GMM method*

الملخص:

تهدف هذه الورقة البحثية إلى إجراء دراسة إحصائية لقياس أثر الشمول المالي على النمو الاقتصادي في مجموعة من الدول المتقدمة والنامية المختارة وفقا لتوافر البيانات خلال الفترة (2010-2021) من خلال بناء مؤشر مركب للشمول المالي لكل دولة باستخدام منهجية سارما، وتطبيق نموذج التحليل الديناميكي لبيانات البانل متبعة في ذلك أسلوب نظام العزوم المعممة في المدى القصير والطويل. تمثلت نتائج الدراسة في أن للشمول المالي تأثير سلبي معنوي على النمو الاقتصادي في المدى القصير والمتقدمة وتأثير إيجابي غير معنوي على النمو الاقتصادي في المدى الطويل. بينما بالنسبة للدول النامية له تأثير إيجابي معنوي في المدى القصير وتأثير سلبي غير معنوي على المدى الطويل. تؤكد النتائج أن تأثير الشمول المالي على النمو الاقتصادي يختلف من دولة إلى أخرى بسبب اختلاف العوامل الاقتصادية والاجتماعية.

الكلمات المفتاحية: الشمول المالي، النمو الاقتصادي، بيانات البانل، نظام العزوم المعممة

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## **1. INTRODUCTION**

In recent years, enhancing financial inclusion has been a priority strategic in many countries across the world either developed or developing economies. Especially after being selected from the G20 as an essential key in addressing sustainable development goals and an inclusive economic growth. Making financial services available to micro, small and medium sized enterprises, increasing investment rate (Alliance for Financial Inclusion (afi), 2021), allowing excluded people to expand their economic activities and facilitating the access to financial services (Kumar Saha, Qin, & Inaba, 2023).

Many studies have been examined theoretically and empirically the relationship between financial inclusion and economic growth. (Azimi & Jiun Chia, 2022) Found that financial inclusion has a positive impact on economic growth whatever the income level and the regional classification. Similarly, (Lfediora, et al., 2022) examined the impact of financial inclusion dimensions on economic growth in SSA countries and proved that penetration and availability of bank branches and ATM machines enhance economic growth but not the usage dimension. Also the empirical results of (Alabdulrazag , Harrathi, & Alsowaidam, 2021) research paper showed that financial inclusion promote GDP per capital in Saudi Arabia.

Furthermore, (Silue, 2021) empirical research results confirmed the high positive effect of digital FI on economic growth through an active mobile money account. (Musa, Magahi, & Salisu, 2022) Study examined the impact of FI on economic growth in Nigeria according to the effect of commercial bank branches and automated teller machines and mobile money transactions, the results indicated that each of them positively affect GDP in the long run. (Yakubu & Benyaminu, 2021) Examined the relationship between FI and economic growth in West African States through financial openness, they found that FI have a positive significant effect on economic growth.

Recent studies, analyzed by (Kumar Saha, Qin, & Inaba, 2023) claims that FI can improve economic growth by enhancing the accessibility to financial services especially for low-income households. (kim, 2016) Estimated the relationship between FI, income inequality and economic growth, the finding showed that FI can positively influence economic growth by ameliorating income inequality. In addition, (Kim, Yu, & Hassan, 2018) founded that FI has positive effect on economic growth in (OIC) countries. (Adedokun, Adekunle, & Akande, 2022) Investigated the relationship between financial inclusion and economic growth in sub Saharan African upper-middle income countries and the findings reveals that financial inclusion positively affect economic growth.

This study aims to examine and compared this impact, among different economies both developed and developing with different economic growth level. Based on the previous studies, the hypothesis proposed in this study are:

H1: Financial Inclusion positively significantly influences economic growth in developed countries.

H2: Financial Inclusion positively significantly influences economic growth in developing countries.

## 2. METHODOLOGY AND DATA

### 2.1. Data description and variables

The statistical study based on unbalanced panel data analysis of total 80 countries, separated into 31 developed countries and 49 developing countries selected according to the World Economic Situation and Prospect report (WESP) by UN (United Nations, 2023) and limited to availability of data over the period of twelve (12) years from 2010 to 2021. The annual data collected from Financial Access Survey 2022 issued by International Monetary Fund (IMF) and the World Development Indicators (WDI) of the World Bank.

The independent variable in this study is the financial inclusion index, which consists of three dimensions: Banking Penetration dimension measured by Number of deposit accounts with commercial banks per1000adults. Availability of banking services dimension (geographical availability) indicated by 2 indicators: Number of Commercial bank branches per100,000 adults and Number of ATMs per 100,000 adults in addition to the usage of banking system dimension which also indicated by 2 indicators that are: Outstanding deposits with commercial banks (%of GDP) and Outstanding loans from commercial banks (%of GDP). The dependent variable is economic growth measured by GDP per capital. For the control variables used that may also affect economic growth are inflation rate (consumer price annual percent changes), population growth, Domestic credit to private sector to GDP, Trade as percentage of GDP.

**Table 1.** Variables description

Variable	Unit of measurement	Description	Sources
<b>1.The independent variable</b> Financial inclusion index	Index scaled between 0 and 1	A multidimensional index constructed according to Sarma approach	Financial Access Survey (IMF)
<b>2.The dependent variable</b> GDP per capital	US dollar	Gross Domestic Product per capital	(WDI)
<b>3.The control variables</b>			
Inflation rate	%	Annual percentage changes in consumer prices	(WDI)
Trade openness	%	Refers to the total of the imports and exports of goods and services to GDP	(WDI)
Population growth	%	Represent the annual percentage of population growth	(WDI)
Domestic Credit to private sector to GDP	%	Credit to private sector as a percentage of GDP	(WDI)

*Source: Author's creation*

## 2.2. Measuring financial inclusion index

Many studies have been tried to measure financial inclusion by constructing a multidimensional index, after being determined by the G20 in three principles dimensions: access to financial services, usage of financial services and the quality of the products (Global partnership for financial inclusion, 2012). Sarma methodology (Sarma, 2012) proposed a multidimensional index (accessibility, availability and usage dimensions). While (Càamara & Tuesta, 2014) applied the two stage PCA model to estimate financial inclusion index through three sub-indices (usage, barriers and access). This study followed Sarma methodology to measure FII across countries.

-The accessibility dimension: indicated by the owners of a formal financial account in an economy (banked population size), measured by the number of deposit accounts with commercial banks per 1000 adults, a weight (1) assigned to this dimension.

-The availability dimension: refers to the availability of financial institutions outlets (office, branches, Automated teller machines), that allow people to easily access to financial service. This dimension measured by two sub-indicators; he number of commercial bank branches per 100,000 adults and the number of ATMs per 100,000 adults. A weight of (2/3) attached to bank branches and (1/3) used for ATMs indicator.

-The usage of financial services: having a financial account does not mean an inclusive financial system, it must also using banking services for credit, payments, remittances, transfer, etc. This dimension measured by the volume of credit and deposit to adult individuals as a proportion of GDP, indicated by outstanding deposits with commercial banks (% GDP) and outstanding loans from commercial banks (of % GDP). A weigh (0.5) assigned to each dimension.

The following table summarized the financial inclusion dimensions:

**Table 2.** Financial inclusion dimensions

Financial inclusion dimensions	Indicators	weights
Accessibility dimension	Number of deposit accounts with commercial banks per1000adults	1
Availability of banking services	Number of Commercial bank branches per100,000 adults	2/3
	Number of ATMs per 100,000 adults	1/3
Usage of banking system	Outstanding deposits with commercial banks (%of GDP)	0.5
	Outstanding loans from commercial banks (%of GDP)	0.5

*Source: Author's creation*

The measuring of multidimensional index of financial inclusion requires accounting a dimension index for each dimensions of FI using the following formula (1):

$$d_i = w_i \frac{A_i - m_i}{M_i - m_i} \quad (1)$$

Where  $d_i$ : represent dimension,  $w_i$ : weight of dimension  $i$ ,  $A_i$ : Actual value of dimension  $i$ ,  $m_i$ : the minimum value,  $M_i$ : the maximum value fixed by specific rule. Ensuring that  $0 \leq d_i \leq w_i$ . The lower limit was fixed on 0 as minimum value for all the dimensions, while the maximum value is (0.90).

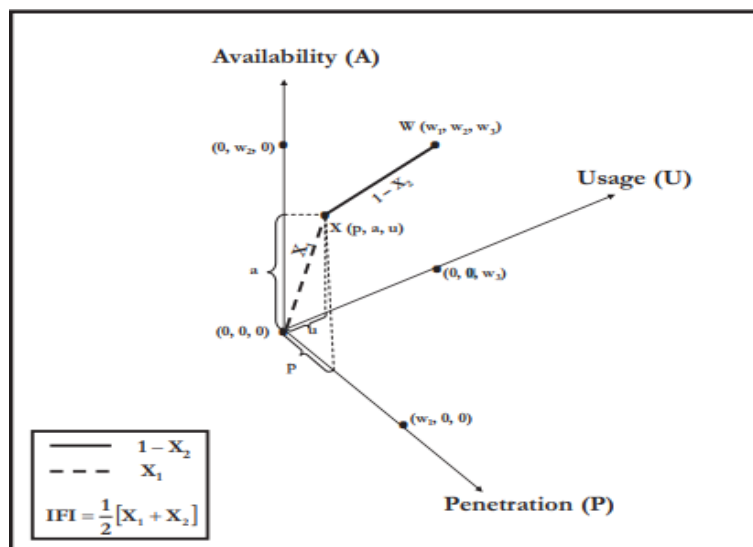
The  $n$  dimensions of financial inclusion will be represented by a point  $X=(d_1, d_2, d_3, \dots, d_n)$ , and in the  $n$  dimensional space the point  $O=(0,0,0, \dots, 0)$  represents the point indicating the worst situation, while  $W=(w_1, w_2, \dots, w_n)$  represent the highest achievement in all the dimensions. Measuring the country level of financial inclusion based on the location of the three points ( $X$ ,  $W$  and  $O$ ), large distance between  $X$ ,  $O$  indicate higher level of financial inclusion, and smaller distance between  $X$ , and  $W$  indicate higher financial inclusion (figure01). Sarma used a simple average of the distance between  $X$  and  $O$  and the inverse distance between  $O$  and  $W$ , to make them lie between 0 and 1. This ensure that FI index takes a single value lying between zero and one ( $0 \leq FII \leq 1$ ), where 0 represent a complete financial exclusion and 1 represent a complete financial inclusion. However to compute FII,  $X_1$  (distance between  $X$  and  $O$ ) and  $X_2$  (inverse distance between  $X$  and  $W$ ) must be firstly calculated, thus taking the following formula:

$$X_1 = \frac{\sqrt{d_1^2 + d_2^2 + \dots + d_n^2}}{\sqrt{(w_1^2 + w_2^2 + \dots + w_n^2)}} \quad (2)$$

$$X_2 = 1 - \frac{\sqrt{(w_1 - d_1)^2 + (w_2 - d_2)^2 + \dots + (w_n - d_n)^2}}{\sqrt{(w_1^2 + w_2^2 + \dots + w_n^2)}} \quad (3)$$

$$FII = \frac{1}{2} (X_1 + X_2) \quad (4)$$

**Fig.1.** Graphical explication of Sarma approach



Source: (Sarma, 2012, p. 15)

### 2.3. Methodology

The study used the Hsiao test to indicate the most appropriate model either panel data analysis or dynamic panel data. It is important to indicate the homogeneous of the variables used in the estimated model.

The homogeneity test is based on various fisher tests, takes the following formula: where (N-1) (K+1) and NT-N (K+1) degrees of freedom and K explanatory variables and RSSr is the sum of squared residuals of the pooled modem: (Khouiled, 2018).

$$F = \frac{(RSSr - RSSu) / [(N - 1)(K + 1)]}{RSSu / [NT - N(K + 1)]}$$

This test is used to know the data are either homogeneous (H0) or not (H1):

$$H0: \alpha_i = \alpha \quad \beta_i = \beta$$

$$H1: \alpha_i \neq \alpha \quad \beta_i \neq \beta$$

The table below showed the results estimated of the Hsiao test for both developed and developing countries, as it is mentioned the p-value is greater than 0.05 as a result the null hypothesis is rejected, the dynamic panel regression is the appropriate model

**Table 6.** Hsiao test for developed countries database

<b>Developed countries</b>			
<b>Hypothesis</b>	<b>F-stat</b>	<b>P-value</b>	<b>Decision</b>
H1	166.83421	5.08E-153	Rejection
H2	8.1743113	1.723E-38	Rejection
H3	228.45001	4.88E-204	Rejection
<b>Developing countries</b>			
H1	79.260605	1.71E-123	Rejection
H2	6.2562479	1.528E-30	Rejection
H3	132.75872	4.71E-167	Rejection

*Source: Author's computations using STATA18*

This study based on two-step system generalized method of moment (SYS-GMM), to estimate the statistical effect of financial inclusion on economic growth the following panel equation was supposed:

$$GDPPC_{it} = \alpha_0 + \beta_1 GDPPC_{it-1} + \beta_2 FII_{it} + \delta U_{it} + \epsilon_i$$

Where  $\alpha_0$ : constant,  $\beta_0$ :Variable coefficient GDPPC: Gross Domestic product per capital, as dependent variable  $GDPPC_{it-1}$ :the lag value of GDPPC (instrumental variable). FII: financial inclusion index the principal independent variable,  $U_{it}$  is a multivariate random variable (vector variable) of the control variables, which consist of inflation rate, trade openness, population growth, credit to private sector  $\epsilon_i$ : Error term. And  $i=1, \dots, n$  refers to the cross sectional while  $t=1, \dots, n$  refers to the time series.

### 3. RESULTS AND DISCUSSION

#### 3.1. Empirical results

The study sample 80 countries, 31 developed countries and 49 developing countries to analyze the statistical effect of financial inclusion on economic growth over the period (2010-2021). Thus totaling 372 observation for developed countries and for 588 observations developing countries.

##### 3.1.1. Descriptive statistics

The following (table03) represent the descriptive statistics of the variables employed in this model for both developed and developing countries. The average of financial inclusion index during the period from 2010 to 2021 across the 31 developed countries is (0.75), while it is (0.71) in the selected 49 developing countries.

It shows that there is a small gap in financial inclusion index between developed countries as

indicated by the significant difference between a min (0.503411) and max value (0.8001426). For the economic growth measured by gross domestic product per capital, there is a large difference between developed countries.

While it indicates that, there is a large gap between financial inclusion index in developing countries indicated by the large difference between the minimum (0.243833) and the maximum value (0.8068776). Similarly, there is a large difference in gdppc level between developing countries, indicated by the min (430.9932) and the max value (12556.33)

**Table 3.** Descriptive statistics

<b>Developed countries</b>					
<b>Variables</b>	<b>Observation</b>	<b>Mean</b>	<b>Std. deviation</b>	<b>Minimum</b>	<b>Maximum</b>
GDPPC	372	26420.68	20235.38	2201.775	100172.1
FII	369	0.7514112	0.0429471	0.5034109	0.8001426
Inflation rate	372	2.096633	2.529813	-2.093333	19.59649
Population growth	372	0.5731078	0.8821622	-4.256649	5.939765
Trade openness	367	102.6718	41.67356	28.49847	252.2495
CPS (%GDP)	363	94.02887	77.1298	27.77036	525.6432
<b>Developing countries</b>					
GDPPC	588	3687.814	2431.18	430.9932	12556.33
FII	580	0.7115468	0.1023753	0.243833	.8068776
Inflation rate	587	6.685185	26.57585	-3.749145	557.2018
Population growth	582	21.08897	24.06259	-1.854259	102.1619
Trade openness	584	77.21781	37.44368	24.70158	347.9965
CPS (% GDP)	578	38.55614	25.76752	3.926196	182.8681

*Source: Author's computations using STATA18*

### 3.1.2. Correlation analysis

Table (04) represent the correlation test, the results reveals that financial inclusion index has a positive insignificant relationship with GDP per capital in developed countries, while it has a positive significant relationship on the GDP per capital in developing countries. The study also found a negative relationship between GDP per capital and inflation rate for both developed and developing countries.



**Table 4.** Correlation analysis

Developed countries						
Variables	GDPPC	FII	Inflation rate	Population growth	Trade openness	CPS (% GDP)
GDPPC	1.0000					
FII	0.0179 0.7311	1.0000				
Inflation rate	-0.3465* 0.000	-0.0235 0.6527	1.0000			
Population growth	0.0545 0.2947	0.1973* 0.0100	0.1704* 0.0100	1.0000		
Trade openness	0.3211* 0.0000	0.1410* 0.0071	-0.1177* 0.0241	-0.0151 0.7726	1.0000	
CPS (% GDP)	0.0512 0.3305	-0.0973 0.0651	-0.1732* 0.0009	-0.3137* 0.0000	-0.1117* 0.0347	1.0000
Developing countries						
GDPPC	1.0000					
FII	0.0995* 0.0166	1.0000				
Inflation rate	-0.0950* 0.0213	-0.0485 0.2433	1.0000			
Population growth	0.1926* 0.0000	0.0113 0.7879	-0.0409 0.3252	1.0000		
Trade openness	-0.0245 0.5547	-0.0278 0.5058	-0.0504 0.2237	-0.0402 0.3343	1.0000	
CPS (% GDP)	0.4613* 0.0000	-0.0338 0.4197	-0.1210* 0.0036	0.0638 0.1253	0.0021 0.9599	1.0000

\*indicate the level of sig (0.05)

*Source: Author's computations using STATA18*

### 3.1.3. Unit root test

The study used the unit root test to measure the stationarity of the variables. The results of the test presented in table (05), it shows that all variable of the study are stationary at level for both developed and developing countries.

Table 5. Unit root test

Developing countries			Developed countries		
Variable	Level		Variable	Level	
	T-statistic	P-value		T-statistic	P-value
GDPPPC	-2.8249	0.0024	GDPPC	-4.0690	0.0000
FII	-16.5984	0.0000	FII	-4.8660	0.0000
Inflation rate	-10.6257	0.0000	Inflation rate	-9.1930	0.0000
Population growth	1.3165	0.9060	Population growth	2.5125	0.9940
Trade openness	-9.4661	0.0000	Trade openness	-2.5256	0.0058
CPS (% GDP)	-6.2708	0.0000	CPS (% GDP)	-4.4462	0.0000

*Source: Author's computations using STATA18*

### 3.1.4. Impact of financial inclusion in developed countries

The following table represent the estimation results of the impact of financial inclusion on economic growth in developed countries using two-step System Generalized Method of Moment (SYS-GMM). It shows that financial inclusion significantly at (0.05) and negatively influence economic growth in the short run regression for the two steps system GMM.

**Table 6.** The impact of financial inclusion on economic growth in developed countries during (2010-2021)

<b>Balanced panel: 2010-2021, yearly</b>		
<b>Dependent variable: GDP per capital</b>		
<b>Variables</b>	<b>One step system GMM</b>	<b>Two step system GMM</b>
Lag of dependent variable (Lagdppe)	1.156578*** (6.75)	1.070721*** (5.95)
Fii (financial inclusion index)	-47.85338** (-2.44)	-60.13351** (-2.25)
Inflation rate	2619.516** (2.49)	30380.596*** (2.72)
Population growth	18690.98** (2.10)	23383.18* ( 1.90)
Trade openness	80.02157 (1.02)	88.492 (1.11)
Credit to private sector	-0.0404845 (-0.00)	-18.19159 (-0.65)
Constant	-25085.29 (-1.29)	-21177.7 (-1.06)
<b>Diagnostic tests</b>		
Observations	341	341
Number of countries	31	31
Number of instruments	13	13
Arellano-Bond test for AR(2)	0.977	0.973
Hansen J statistic	0.145	0.145

Note: \* p<.1; \*\* p<.05; \*\*\* p<.01, t-statistic (in parentheses)

*Source: Author's computations using STATA18*

The AR2 in both two-step system GMM (0.977) is greater than the level of significance which indicate that there is no second order autocorrelation, and also the Hansen J statistic (0.145) show that there is no over identification problem in the analysis.

The table below shows that financial inclusion index insignificantly and positively influence economic growth in the long run GMM.

**Table 7.** The long run system GMM estimations

GDPPC	Coefficient	Std. err	Z	P-value	[95% Conf. interval]
_nl_1	850.289	2343.85	0.36	0.717	-3743.573 5444.151

*Source: Author's computations using STATA18*

### 3.1.5. The impact of financial inclusion on economic growth in developing countries

Table 08 investigates the impact of financial inclusion on economic growth in developing countries. The results reveals financial inclusion has a significant positive coefficient, which means that financial inclusion index positively affect the GDP per capital in the short run regression.

The AR2 in both two-step system GMM (0.065-0.128) is greater than the level of significance (0.05) which indicate that there is no second order autocorrelation, and the Hansen J statistic(0.154) show that there is no over identification problem in the analysis.

**Table 8.** The impact of financial inclusion on economic growth in developing countries during (2010-2021)

<b>Balanced panel: 2010-2021, yearly</b>		
<b>Dependent variable: GDP per capital</b>		
<b>Variables</b>	<b>One step system GMM</b>	<b>Twostep system GMM</b>
Lag of dependent variable (Laggdppc)	1.008454*** (11.53)	1.113107*** (8.64)
Fii (financial inclusion index)	6.804436*** (2.64)	3.699286 (1.44)
Inflation rate	-0.1049782 (-0.16)	-0.3824946 (-0.50)
Population growth	3.160008* (1.85)	3.481961 (1.36)
Trade openness	-11.38974** (-2.32)	-14.81092* (-1.79)
Credit to private sector	-0.50961062 (-0.49)	0.7635364 (0.72)

Constant	426.9928	1870.548
	(0.34)	(1.14)
<b>Diagnostic tests</b>		
Observations	539	539
Number of countries	49	49
Number of instruments	16	16
Arellano-Bond test for AR(2)	0.097	0.212
Hansen J statistic	0.187	0.187

Note: \* p<.1; \*\* p<.05; \*\*\* p<.01, t-statistic (in parentheses)

*Source: Author's computations using STATA18*

The long run effects of financial inclusion index on economic growth, shows that financial inclusion negatively insignificantly influence economic growth.

**Table 9.** The long run GMM estimations

GDPPC	Coefficient	Std. err	Z	P-value	[95% Conf. interval]	
_nl_1	-18.94876	24.33627	-0.78	0.436	-66.64697	28.74945

*Source: Author's computations using STATA18*

### 3.2. Discussion

The discussion part compared the results obtained by SYS-GMM estimation in the short and long run concerning the impact of financial inclusion on economic growth in the selected 31 developed countries and 49 developing countries.

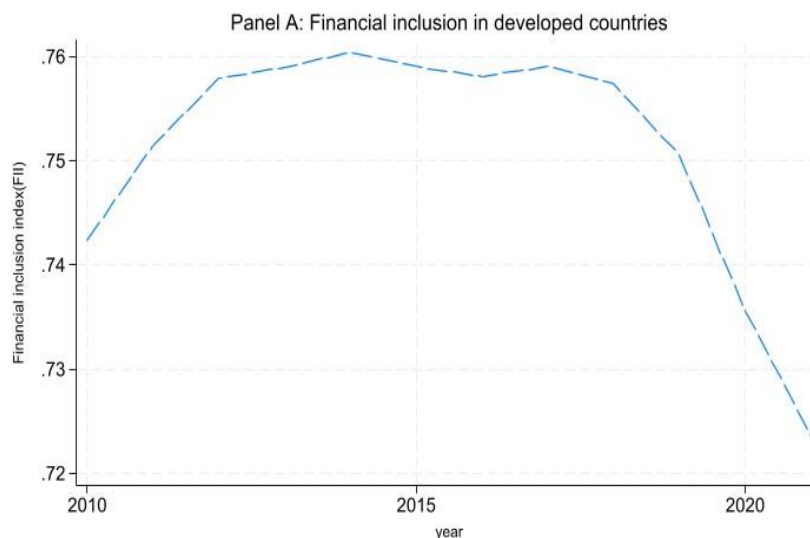
The estimation of the model indicates that financial inclusion negatively significantly influence economic growth in the short run in developed countries (Table 6) .While it has positively impact in the long-run (table 7).

For the developing countries, the estimation results reveals that there is a positive significant relationship between financial inclusion and economic growth in the short run (table 8), similarly to the results getting by (Kumar Saha, Qin, & Inaba, 2023) and (Adedokun, Adekunle, & Akande, 2022) but the estimation of the long run system GMM indicated the negative impact.

The following figure shows the level of financial inclusion over the twelve years in developed countries, financial inclusion index have been declining since 2018 because of the technological revolution and the digital adoption. In many countries, digital financial inclusion have been increasing during the period (2014-2017) where traditional financial inclusion decreased (Wang Tok & Heng, 2022). Because Fintech have been offered especially for unbanked people lower costs and promote the easier way to access to financial service where bank branches may not exist. In high

income economies, the share of adults that make or receive digital payments was 95 percent in the period spanning 2014 to 2021 (World Bank , 2021).

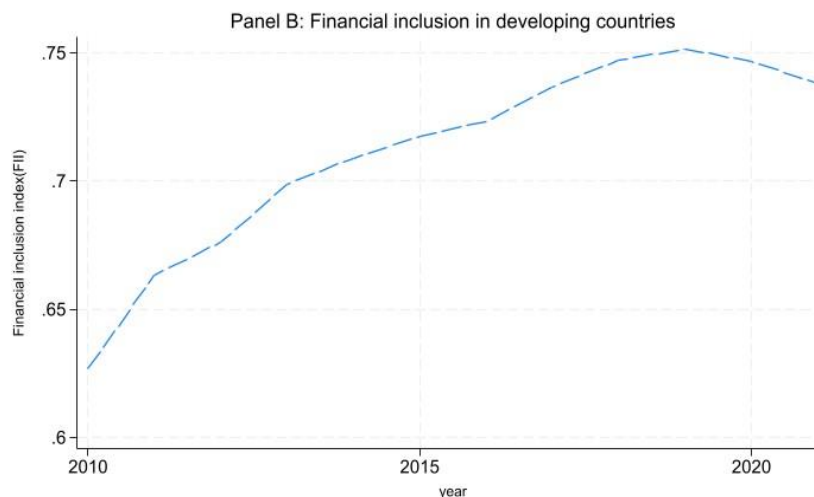
**Fig2.** Financial inclusion index in developed countries



*Source: Author's computations using STATA18*

The progress of financial inclusion index depends on the large variations in terms of income, region, gender, education level and age and disparities between developed and developing economies (United Nations Conference on Trade and Development (UNCTAD), 2021). More developed regions show smaller year over year compared to developing regions where have been increased in the ten years spanning 2011 to 2021 (figure 03), the average rate of account ownership increased by 8 percent points from 63 percent to 71 percent of adults (World Bank , 2021).

**Fig3.** Financial inclusion index in developing countries



*Source: Author's computations using STATA18*

Furthermore, (World Bank , 2021) reveals that having a bank account or the availability of bank branches and automated teller machines (ATM), it is not enough to reach unbanked population about 70 percent of account owners in some countries used their account to receive wages or government payments. Also, increasing accessibility to formal financial services does not enough to improve economic growth.

#### **4. CONCLUSION**

This study examined the impact of financial inclusion on economic growth in selected developed and developing countries, during the period spanning from 2010-2021. The study used Sarma (Sarma, 2012) methodology to construct a multidimensional index of financial inclusion for each country based on the three dimensions: the accessibility, availability and usage of financial services. For this purpose, a dynamic panel model was applied to estimate this relationship between financial inclusion index and economic growth measured by gross domestic product per capital.

The main results reveals that financial inclusion influence economic growth negatively and significantly in the short run, and positively in the long run regression, then we reject the first alternative hypothesis that include the positive significant relationship between financial inclusion and economic growth. The same regression applied on developing countries, and the results shows that financial inclusion positively significantly impact economic growth in the short run, then we accept the second hypothesis, but not in the long run regression.

This finding suggests that policymakers must focus on the long-term effects of adopting a strategy to enhance financial inclusion. Facilitating the access to formal financial services for the excluded people or the unbaked especially in the rural area by reducing costs, enhancing financial literacy and ensuring the effectiveness of the usage of these financial services to positively affect the economic growth. In addition, promoting micro finance for MSME and low income entrepreneurs to expand their Owen business, also improving the empowerment of women in the economy.

#### **5. Bibliography List:**

1. Adedokun, M., Adekunle, A., & Akande, J. (2022). *An investigation of the impact of financial inclusion on economic growth:Evidence from African countries. 12(10), pp. 864-885. doi:10.55493/5002.v12i10.4631;*
2. Alabdulrazag , A., Harrathi, N., & Alsowaidam, O. (2021). *Impact of financial incluision on economic growth in Saudi Arabia: An Autoregressive Distributed Lag Modeling Approach. SAMA Joint research.;*
3. *Alliance for Financial Inclusion (afi). (2021). The global policy forum report ;*
4. *Alliance for financial inclusion. (2010). Financial inclusion measurement for regulators. Data Working Group, Kuala Lumpur, Malaysia. Retrieved from https://www.afi-global.org/sites/default/files/fidwg\_measurementoverview\_porteous\_0.pdf;*
5. *Arab Monetary Fund. (2021). Introduction of financial inclusion for the Arab region initiative (FIARI);*
6. Azimi, M., & Jiun Chia, R. (2022, November). *New insights into the impact of financial inclusion on economic growth: A global prespective. Plos One. doi:https://doi.org/10.1371/journal.pone.0277730;*
7. *Càamara, N., & Tuesta, D. (2014). Measuring Financial inclusion: Multidimensional index. BBVA research.;*
8. *Global partnership for financial inclusion. (2012). G20 Financial inclusion indicators. G20 Financial inclusion indicators;*
9. *Khouiled, B. (2018). Tests of Homogeneity in the panel data with Eviews. Munich Personal RePEc Archive (MPRA);*

10. Kim, D., Yu, J.-S., & Hassan, M. (2018). *Financial Inclusion and economic growth in OIC countries*. *Research in International Business and Finance*, 43(C), pp. 1-14. doi:DOI: 10.1016/j.ribaf.2017.07.178;
11. kim, J.-H. (2016). *A study on the effect of Financial Inclusion on the relationship between income Inequality and Economic Growth*. *Emerging Markets and Finance and Trade*, 52(02), pp. 498-512. doi:10.1080/1540496X.2016.1110467;
12. Kumar Saha, S., Qin, J., & Inaba, K. (2023, February). *The impact of financial inclusion on economic growth in developing countries*. *Journal of accounting, business and finance research*, 16(01), pp. 12-29. doi:10.55217/102.v16i1.607;
13. Lfediora, C., Onochie Offor, K., Festus Eze, E., Takon, S., Ageme, A., Onwumere, J., & Imo Ibe, G. (2022, April 16). *Financial inclusion and its impact on economic growth:Empirical evidence from sub-Saharan Africa*. *Cogent Economics and Finance*, 10(1). doi:https://www.tandfonline.com/action/showCitFormats?doi=10.1080/23322039.2022.2060551;
14. Musa, I., Magahi, S., & Salisu, A. (2022). *Relationship between financial inclusion and economic growth: Evidence from ARDL Modeling*. *Focus on Research in Contemporary Economics (FORCE)*, 3(2), pp. 395-413. Retrieved from https://www.forcejournal.org/index.php/force/article/view/79/56;
15. Sarma, M. (2012, June). *Index of financial inclusion-A measure of financial sector inlussiveness-*. *Centre for International Trade and Development*, pp. 12-20;
16. Silue, T. (2021, Jul). *Financial inclusion and economic growth: Evidence in the digital environment of Developing countries*. *HAL open science*;
17. *United Nations*. (2023). *World Economic Situation Prospects*;
18. *United Nations Conference on Trade and Development (UNCTAD)*. (2021). *Financial inclusion for development: Better access to financial services for women, the poor and migrant work*. *United Nations Conference on trade and development*;
19. Wang Tok, Y., & Heng, D. (2022, May). *Fintech: Financial inclusion or exclusion? Institut of Capacity and development: International Monetary Fund Working paper*;
20. *World Bank* . (2021). *The global findex darabase 2021*;
21. *World Bank*. (2021). *Financial inclusion, Women, and building Back Better*;
22. Yakubu, I., & Benyaminu, A. (2021). *Financial inclusion and Economic growth in west Africa: The Moderating Effect of financial openness*. *Munich Personal RePEc Archive*;

## 6. Appendices

### 1 .Hsiao test of developed countries panel data

```

Stata/SE 18.0
File Edit Data Graphics Statistics User Window Help
. di in y "F1 = " in gr `F1'
F1 = 166.83421
.
. di in y "F2 = " in gr `F2'
F2 = 8.1743113
.
. di in y "F3 = " in gr `F3'
F3 = 228.45001
.
. di in y "PvalF1 = " in gr `PvalF1'
PvalF1 = 5.08e-153
.
. di in y "PvalF2 = " in gr `PvalF2'
PvalF2 = 1.723e-38
.
. di in y "PvalF3 = " in gr `PvalF3'
PvalF3 =
Command

```



## 2. Hsiao test of developing countries panel data

```

2 - Stata/SE 18.0 - D:\nadja\These\ping countries.dta
File Edit Data Graphics Statistics User Window Help
F1 = 79.260605
.
. di in y "F2 = " in gr `F2'
F2 = 6.2562497
.
. di in y "F3 = " in gr `F3'
F3 = 132.75872
.
. di in y "PvalF1 = " in gr `PVF1'
PvalF1 = 1.71e-123
.
. di in y "PvalF2 = " in gr `PVF2'
PvalF2 = 1.528e-30
.
. di in y "PvalF3 = " in gr `PVF3'
PvalF3 = 4.71e-167
Command
    
```

## 3. Descriptive statistics of developed countries

Variable	Obs	Mean	Std. dev.	Min	Max
gdppc	372	26420.68	20235.38	2201.775	100172.1
fii	369	.7514112	.0429471	.5034109	.8001426
inflation_~e	372	2.096633	2.529813	-2.093333	19.59649
population~h	372	.5731078	.8821622	-4.256649	5.939765
tradegdp	367	102.6718	41.67356	28.49847	252.2495
cpsgdp	363	94.02887	77.1298	27.77036	525.6432

## 4. Descriptive statistics of developing countries

Variable	Obs	Mean	Std. dev.	Min	Max
gdppc	588	3687.814	2431.18	430.9932	12556.33
fii	580	.7115468	.1023753	.2438333	.8068776
inflation_~e	587	6.685185	26.57585	-3.749145	557.2018
population~h	582	21.08897	24.06259	-1.854259	102.1619
tradegdp	584	77.21781	37.44368	24.70158	347.9965
cpsgdp	578	38.55614	25.76752	3.926196	182.8681

### 5. Correlation analysis of developed countries

	gdppc	fii	inflat~e	popula~h	tradegdp	cpsgdp
gdppc	1.0000					
fii	0.0179 0.7311	1.0000				
inflation~e	-0.3465* 0.0000	-0.0235 0.6527	1.0000			
population~h	0.0545 0.2947	0.1973* 0.0001	0.1704* 0.0010	1.0000		
tradegdp	0.3211* 0.0000	0.1410* 0.0071	-0.1177* 0.0241	-0.0151 0.7726	1.0000	
cpsgdp	0.0512 0.3305	-0.0973 0.0651	-0.1732* 0.0009	-0.3137* 0.0000	-0.1117* 0.0347	1.0000

### 6. Correlation analysis of developed countries

	gdppc	fii	inflat~e	popula~h	tradegdp	cpsgdp
gdppc	1.0000					
fii	0.0995* 0.0166	1.0000				
inflation~e	-0.0950* 0.0213	-0.0485 0.2443	1.0000			
population~h	0.1926* 0.0000	0.0113 0.7879	-0.0409 0.3252	1.0000		
tradegdp	-0.0245 0.5547	-0.0278 0.5058	-0.0504 0.2237	-0.0402 0.3343	1.0000	
cpsgdp	0.4613* 0.0000	-0.0338 0.4197	-0.1210* 0.0036	0.0638 0.1253	0.0021 0.9599	1.0000

### 7. Dynamic panel estimation, one-step system GMM of the impact of financial inclusion on economic growth in developed countries during (2010-2021)

Group variable: country_id	Number of obs	=	341
Time variable : year	Number of groups	=	31
Number of instruments = 13	Obs per group: min	=	11
Wald chi2(6) = 591.51	avg	=	11.00
Prob > chi2 = 0.000	max	=	11

	gdppc	Robust		z	P> z	[95% conf. interval]	
	Coefficient	std. err.					
laggdppc	1.156578	.1714031	6.75	0.000	.8206341	1.492522	
fii_n	-47.85338	19.6395	-2.44	0.015	-86.34609	-9.360663	
inflation_rate	2619.516	1052.947	2.49	0.013	555.7779	4683.255	
population_growth	18690.98	8893.475	2.10	0.036	1260.095	36121.87	
tradegdp_n	80.02157	78.59816	1.02	0.309	-74.02799	234.0711	
cpsgdp_n	-.0404845	48.54018	-0.00	0.999	-95.1775	95.09653	
_cons	-25085.29	19435.23	-1.29	0.197	-63177.64	13007.06	

Arellano-Bond test for AR(1) in first differences: z = -1.24 Pr > z = 0.214  
 Arellano-Bond test for AR(2) in first differences: z = 0.03 Pr > z = 0.977

Sargan test of overid. restrictions: chi2(6) = 6.77 Prob > chi2 = 0.343  
 (Not robust, but not weakened by many instruments.)  
 Hansen test of overid. restrictions: chi2(6) = 9.54 Prob > chi2 = 0.145  
 (Robust, but weakened by many instruments.)

Variable	Active
laggdppc	1.1565781***
fii_n	-47.853375**
inflation~ve	2619.5164**
population~h	18690.985**
tradegdp_n	80.021567
cpsgdp_n	-.04048448
_cons	-25085.29

Legend: \* p<.1; \*\* p<.05; \*\*\* p<.001

Dynamic panel-data estimation, two-step system GMM

Group variable: country\_id Number of obs = 341  
 Time variable : year Number of groups = 31  
 Number of instruments = 13 Obs per group: min = 11  
 Wald chi2(6) = 437.39 avg = 11.00  
 Prob > chi2 = 0.000 max = 11

gdppc	Corrected		z	P> z	[95% conf. interval]	
	Coefficient	std. err.				
laggdppc	1.070721	.1800512	5.95	0.000	.7178275	1.423615
fii_n	-60.13351	26.69449	-2.25	0.024	-112.4538	-7.81327
inflation_rate	3038.596	1118.838	2.72	0.007	845.7133	5231.478
population_growth	23383.18	12280.72	1.90	0.057	-686.5769	47452.95
tradegdp_n	88.492	79.71757	1.11	0.267	-67.75156	244.7356
cpsgdp_n	-18.19159	27.83171	-0.65	0.513	-72.74075	36.35757
_cons	-21177.7	20055.28	-1.06	0.291	-60485.32	18129.92

Arellano-Bond test for AR(1) in first differences: z = -1.08 Pr > z = 0.279  
 Arellano-Bond test for AR(2) in first differences: z = 0.03 Pr > z = 0.973

Sargan test of overid. restrictions: chi2(6) = 6.77 Prob > chi2 = 0.343  
 (Not robust, but not weakened by many instruments.)  
 Hansen test of overid. restrictions: chi2(6) = 9.54 Prob > chi2 = 0.145  
 (Robust, but weakened by many instruments.)

gdppc	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
_nl_1	850.289	2343.85	0.36	0.717	-3743.573	5444.151

### 8. Dynamic panel estimation, two-step system GMM of the impact of financial inclusion on economic growth in developing countries during (2010-2021)

Dynamic panel-data estimation, one-step system GMM

Group variable: country_id	Number of obs	=	539
Time variable : year	Number of groups	=	49
Number of instruments = 16	Obs per group: min	=	11
Wald chi2(6) = 436.81	avg	=	11.00
Prob > chi2 = 0.000	max	=	11

laggdppc	Coefficient	Robust std. err.	z	P> z	[95% conf. interval]	
gdppc	1.008454	.0874594	11.53	0.000	.8370364	1.179871
fii_n	6.804436	2.577369	2.64	0.008	1.752885	11.85599
inflationrate_n	-.1049782	.6529599	-0.16	0.872	-1.384756	1.1748
populationgrowth_n	3.160008	1.704362	1.85	0.064	-.1804803	6.500497
tradegdp_n	-11.38974	4.91049	-2.32	0.020	-21.01412	-1.765353
cpsgdp_n	-.5096106	1.030413	-0.49	0.621	-2.529182	1.509961
_cons	426.9928	1247.359	0.34	0.732	-2017.786	2871.772

Arellano-Bond test for AR(1) in first differences: z = -1.71 Pr > z = 0.086  
 Arellano-Bond test for AR(2) in first differences: z = -1.66 Pr > z = 0.097

Sargan test of overid. restrictions: chi2(9) = 18.06 Prob > chi2 = 0.034  
 (Not robust, but not weakened by many instruments.)  
 Hansen test of overid. restrictions: chi2(9) = 12.48 Prob > chi2 = 0.187  
 (Robust, but weakened by many instruments.)

Variable	Active
gdppc	1.0084537***
fii_n	6.8044356***
inflationr~n	-.10497824
population~n	3.1600081*
tradegdp_n	-11.389736**
cpsgdp_n	-.50961062
_cons	426.99277

Legend: \* p<.1; \*\* p<.05; \*\*\* p<.01

Dynamic panel-data estimation, two-step system GMM

Group variable: country_id	Number of obs	=	539
Time variable : year	Number of groups	=	49
Number of instruments = 16	Obs per group: min	=	11
Wald chi2(6) = 247.27	avg	=	11.00
Prob > chi2 = 0.000	max	=	11

laggdppc	Coefficient	Corrected std. err.	z	P> z	[95% conf. interval]	
gdppc	1.113107	.1288092	8.64	0.000	.8606461	1.365569
fii_n	3.699286	2.5712	1.44	0.150	-1.340173	8.738746
inflationrate_n	-.3824946	.7670536	-0.50	0.618	-1.885892	1.120903
populationgrowth_n	3.481961	2.567087	1.36	0.175	-1.549438	8.513359
tradegdp_n	-14.81092	8.258029	-1.79	0.073	-30.99636	1.374518
cpsgdp_n	.7635364	1.055712	0.72	0.470	-1.305621	2.832694
_cons	1870.548	1644.583	1.14	0.255	-1352.775	5093.87

Arellano-Bond test for AR(1) in first differences: z = -1.45 Pr > z = 0.148  
 Arellano-Bond test for AR(2) in first differences: z = -1.25 Pr > z = 0.212

Sargan test of overid. restrictions: chi2(9) = 18.06 Prob > chi2 = 0.034  
 (Not robust, but not weakened by many instruments.)  
 Hansen test of overid. restrictions: chi2(9) = 12.48 Prob > chi2 = 0.187  
 (Robust, but weakened by many instruments.)