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Abstract: In the recent years, financial inclusion has taken a center stage in policy discussions regarding how to achieve higher growth rates and lower poverty levels. The existing literature analyzing the relation between financial inclusion and GDP mostly assumes a one way relation from financial inclusion to GDP, ignoring any possible reverse causality relationships. Furthermore, the literature adopts a financial inclusion index, or focuses on several indicators such as the number of bank branches, ATMs or the share of people having an account. Because financial inclusion is a broader concept having a multitude of dimensions, it is important to analyze the causal linkages between different financial inclusion indicators and GDP. In this paper, we analyze the nature and the direction of the causality between economic growth and a large number of financial inclusion indicators in MENA countries by adopting the recently developed nonlinear and nonparametric Kernel causality approach. Our analysis suggests that financial inclusion increases as the share of women having bank accounts, the share of adults with primary education having an account as well as the share of adults having a mobile account increases. We also identify the relation between main barriers to financial inclusion and GDP, and find that affordability and having insufficient funds are associated with GDP growth.

Key Words: Financial inclusion, MENA, Kernel causality

1. Introduction

Financial inclusion refers to the "access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way" (World Bank, 2021). Improving financial inclusion to achieve higher growth rates and eradicate poverty has gained considerable attention as a policy agenda in the recent years. World Bank underlines the importance of financial inclusion as an important tool to reduce poverty (World Bank, 2021). Furthermore, G20 Finance Ministers and Central Bank Governors committed to facilitate financial inclusion worldwide in the G20 meeting held in Germany in 2017 (Global Partnership for Financial Inclusion (GPFI), 2021). The literature also highlights the potential benefits of financial inclusion by making it possible for households to obtain the necessary funds to undertake new investment projects, providing funds for emergency situations, and facilitating the pooling of financial resources in the financial markets. Moreover, financial inclusion is found to positively affect economic growth (Demirgüç-Kunt and Levine 2009; Demirgüç-Kunt et al., 2017; Sharma, 2016; Lenka and Sharma, 2017; Sethi and Sethy, 2018; Gul et al., 2018) and reduce income inequality (Lan and Thuong, 2019; Ouechtati, 2020). As a result, it is important both theoretically and practically to understand the relationship between financial inclusion and GDP.

In theory, the causal relationship between financial inclusion and GDP can run in either direction. On the one hand, according to the "finance-led growth hypothesis", financial inclusion can stimulate growth by increasing capital accumulation. On the other hand, an increase in GDP can increase access to financial services and thereby lead to higher financial inclusion. There can be a two way relation between these variables as well. Furthermore, it is also possible that a causal relationship between financial inclusion and economic growth does not exist, supporting the so-called "neutrality hypothesis". Although the relation between financial inclusion and economic growth has been a subject of various studies, empirical findings so far have provided mixed evidence. Applying a Granger Causality analysis, Sharma (2016) finds that number of deposits and loan accounts increase economic growth in India. Sethi and Acharya (2018) examine the relationship between financial inclusion and economic growth for 31 countries for the period between 2004-2010 and using a panel causality analysis, they document that there is a bidirectional causality between financial inclusion and economic growth. Using annual data between 2004-2017 for SAARC countries, Singh and Stakic (2021) suggest that there is bidirectional causality between financial inclusion and economic growth in the sample countries. Despite its importance, surprisingly, there are only a few papers examining the link between financial inclusion and

economic growth in MENA countries. Emara and El Said (2020) explores the relation between financial inclusion and economic growth for MENA countries employing a GMM analysis. By using the number of bank accounts (per 1000 adult population), bank accounts for corporates/enterprises, and the number of bank branches and ATMS (per 100,000 people) and percentage of firms using banks to measure financial inclusion, they find that financial inclusion is positively associated with GDP growth rate in the sample countries. Yones (2018) also assesses the relationship between financial inclusion and growth for MENA countries and finds that financial inclusion as measured by the number of ATMs, number of depositors, number of borrowers, number of account and credit as percentage of GDP has a positive effect on GDP. In a recent study, Cama et al. (2022) find that financial inclusion in MENA region is positively associated with the size of gross capital formation in the industries with low R&D expenditures.

Reviewing the existing literature, one can make two observations. First, it is seen that most of the earlier studies on the financial inclusion and economic growth nexus assume a one-way causal relationship from financial inclusion to economic growth, ignoring any possible reverse causality between these two variables. Apart from the issues related with methodology, it is also observed that the majority of the studies consider only a few number of indicators of financial inclusion. This is because of the fact data on financial inclusion was limited to country-specific survey evidence on some financial access indicators such as number of bank branches, ATMs and account penetration (Beck, 2016). However, financial inclusion is a broad concept having a multitude of dimensions and the construction of Global Financial Index has made it feasible to undertake a more detailed analysis. According to Global Financial Inclusion Index (Demirgüç-Kunt et al., 2018), financial inclusion is composed of seven categories each of which has several other sub-sections. These indicators are related with account information, saving at a financial institution, debit card ownership, borrowing as well as credit card ownership. The subcategories are also divided on the basis of gender, age, education and the income level. Examining the relationship between these subcategories and GDP growth can potentially provide a wealth of information useful to policy makers. However, such analysis has not been undertaken until today due to data limitations.

In order to address the aforementioned gaps in the literature, we offer two novel contributions to extend our current understanding of financial inclusion and economic growth nexus. First, we analyze the causal relationship between multiple indicators of financial inclusion and GDP growth in MENA countries to assess which aspects matter the most, so that policy makers can design

policies accordingly. We especially focus on the causal effects of the number of bank accounts, digital financial inclusion as well as barriers to financial inclusion. It is crucial to analyze these effects in MENA countries because most countries in this region are currently adopting various policies towards financial inclusion (Cama et al., 2022). However, a detailed analysis of the subject matter has not been performed for MENA countries, due to the unavailability of sufficiently long time series on financial inclusion.

Our second contribution is methodological. In our study, we adopt a recently developed nonlinear and nonparametric kernel causality approach. To our knowledge, this is the first empirical research to utilize kernel causality in this field. This advanced approach makes it possible to avoid the data limitations that normally encumber analysis for MENA countries and provides a comprehensive and robust framework to establish causal linkages. Its main advantage over the traditional Granger causality is the ability to perform causality analysis using cross-sectional data with a relatively limited number of observations. Consequently, this approach makes it possible to explore the causal effects between many different dimensions of financial inclusion with GDP, which could not be studied in the previous literature.

The rest of the paper is organized as follows: Section 2 describes our methodology and data, section 3 presents empirical results and section 4 concludes.

2. Data and Empirical Methodology

2.1. Data

To measure financial inclusion, we rely on The Global Findex database (Demirgüç-Kunt et. al., 2017), which is the most comprehensive data set providing information on the use of financial services based on national surveys. This unique database is published every three years since 2011, providing financial inclusion data for 2011, 2014 and 2017. While most of the previous indicators of financial inclusion focus on the access to financial services by considering only supply side indicators, the Global Findex data measures the use of financial services, which includes both demand and supply factors (Demirgüç-Kunt et al., 2018). The data consists of three broad categories namely formal accounts, borrowing behavior, and saving behavior. Indicators on account numbers provide information on the mode of access, barriers to account use, and alternatives to formal accounts (Demirgüç-Kunt et al., 2018). These are also provided on the subcategories of gender, age and income levels. In order to analyze these features in a systematic way, we focus on

three main categories namely: Account numbers, digital financial inclusion and barriers to financial inclusion.

Our analysis involves conducting a kernel causality analysis of a large group of indicators of financial inclusion for 20 MENA countries including Turkey and Iran. The primary variable of concern is GDP. We use purchasing power parity adjusted GDP in constant 2017 dollars, obtained from World Bank (2021).

2.2. Methodology

To examine the relation between financial inclusion and GDP, we adopt a Kernel causality analysis. Kernel causality, or instantaneous causality, states that a variable *X* instantaneously causes another variable *Y* if the present value of *Y* is *better predicted* when the present value of *X* is included in the prediction than if it is not. This powerful concept has so far received limited attention due to the difficulty of its implementation with the traditional regression methods. However, thanks to the advances in econometric theory and the increased computational capacity, it has recently become viable to implement kernel causality using computer intensive nonparametric and nonnormal conditional densities. Recently, Vinod (2017) proposed a method to implement kernel causality by adopting the concept of generalized measure of correlation (GMC) developed by Zheng et al. (2012). This analytical framework depends on the comparison of the coefficient of determinations obtained from two-way non-parametric "kernel regressions" (Fousekis, 2020). The advantage of using kernel regressions is their ability to provide a superior fit measured by the squared Pearson correlation coefficient between the observed and the kernel-fitted values (Vinod, 2019). The approach is already adopted by Allen and Hooper (2018), Lister and Garcia (2018), Vinod (2019), and Fousekis (2020) for different applications in economics and finance. Furthermore, Lister and Garcia (2018) discuss that this method of generalized meausure of correlation is the most accurate to date in terms of correctly identifying causality in the CauseEffectPairs benchmark database with a success rate of 70–75 per cent.

Following Fousekis (2020) and Vinod (2017), our framework for kernel causality approach is based on the following two regressions:

$$Y = g(X) + \mathcal{E} = E_{YX} + \mathcal{E} \quad (1)$$

$$X = g'(Y) + \mathcal{E}'_i = E_{XY} + \mathcal{E}' \quad (2)$$

Where $g(X)$ and $g'(Y)$ are nonparametric and unspecified nonlinear functions. Computations of (1) and (2) can be done using the Nadaraya-Watson kernel regression method (Nadaraya,1965; Watson, 1964). For the nonparametric Nadaraya-Watson regressions, the coefficient of determination R^2 is calculated following Hayfield and Racine (2008):

$$R_{YX}^2 = \frac{\left[\sum_{t=1}^{T}(Y_t-\bar{Y})(Y_t-\overline{Y})\right]^2}{\sum_{t=1}^{T}(Y_t-\bar{Y})^2 \sum_{t=1}^{T}(Y_t-\overline{Y})^2} \quad (3)$$

R_{YX}^2 lies in the range of (0,1) and it is similar to the standard coefficient of determination for linear regression models fitted with least squares and includes an intercept term (Fousekis, 2020). The signed square root of R_{YX}^2 gives the generalized measure of correlation between the variables and can be represented as follows:

$$GMC_{YX} = sign\ ({}_{YX})(R_{YX}) \quad (4)$$
$$GMC_{XY} = sign\ ({}_{XY})(R_{XY}) \quad (5)$$

The difference between two population R^2 values is denoted by δ:

$$\delta = GMC_{XY} - GMC_{YX} \quad (6)$$

Based on Equation (6), kernel causality is formally defined as follows:

If δ > 0, $GMC_{YX} > GMC_{XY}$, Y kernel causes X, Y better predicts X than vice versa
If δ = 0, $GMC_{YX} = GMC_{XY}$, kernel cause is bidirectional (7)
If δ > 0, $GMC_{YX} < GMC_{XY}$, X kernel causes Y, X better predicts Y than vice versa

To test the statistical significance of $\hat{\delta}$, we employ the modified *t* test proposed by Vinod (2017). If the test result is significant, H_0: δ = 0 is rejected, implying a one way causality from X to Y or Y to X depending on the value of δ.

3. Empirical Findings

We analyze the causal path between different dimensions of financial inclusion and GDP growth, presenting our results in a set of three tables. The preliminary analysis begins with using a Pearson's

correlation analysis to look for the existence of a relationship between two variables. The Pearson coefficient of correlation varies between -1 and +1, in which higher values represent stronger correlation. If the correlation is equal to zero, this means that there is no connection between the variables, suggesting no causality. A statistically significant Pearson correlation implies that there is a connection between the variables. However, because Pearson correlation does not reveal the direction of causality, in the subsequent step we utilize the nonparametric kernel causality approach in order to capture the asymmetric responses and identify the direction of causality as per (7). The nonparametric kernel regressions are undertaken using the "np" R library provided by Racine and Hayfield (2018), while the test statistics are computed with the "generalCorr" R library by Vinod (2017b).

In the first two columns of Table 1 to Table 3, we provide the Pearson correlation coefficients along with their p-values. In columns 3-7, kernel causality estimations are presented. The final column shows the direction of the causality, if exists.

Causal Paths between Account Numbers and GDP

In the first part of our empirical analysis, we explore the causal paths between account numbers and GDP. More specifically, we examine whether the subcategories provided on the basis of gender, age, education and income level are positively related with GDP. Table 1 illustrates the results of Kernel causality tests on the various indicators of account information and gross domestic product. The first two columns indicate that there is correlation between most of the financial inclusion variables and GDP. Therefore, we can proceed with testing the existence of kernel causality. Columns 3 and 4 present generalized measures of correlation between X and Y GMC_{XY} , and Y and X and GMC_{YX} respectively. The next column shows the difference between these values. We check whether the sign of δ is positive or negative to identify kernel causality. The last column provides p value. If the value in the column entitled `p-value' exceeds 0.05, we fail to reject the null hypothesis: X;Y = 0 at the 5% level.

In Table 1, the null hypothesis that financial inclusion indicator does not Kernel-cause GDP is rejected for five of the variables. The causal relation seems to be insignificant for four variables and there exists bidirectional relation for the rest of the variables. There are a few striking observations revealed by the analysis. First of all, the share of women who has an account Kernel causes GDP. It is known that women do not have formal accounts in most of the developing countries (Aterito et al., 2011). This is also true for most of the MENA countries, in which almost 13 percent of female

has an account at a financial institution (Demirgüç-Kunt and Klapper, 2018). Therefore, increasing the share of women having access to formal accounts may positively affect GDP in these countries. On the other hand, in terms of the share of male adults having an account, causality runs from GDP to financial inclusion. Furthermore, the results confirm that there is unidirectional causality from the share of adults having an account with primary education to GDP. When the causality path is investigated between different income groups and GDP, it is seen that there is bidirectional relation.

Table 1: Kernel causality between use of accounts and GDP

	PEARSON CORR		KERNEL CORR						
GDP per capita, PPP, constant 2017 int. 1000USD	t-stat1	p-value1	GMCyx	GMCxy	δ	t-stat2	p-value2		Cause
Account (% age 15+)	1,872	0,034	0,767	0,726	0,041	-0,582	0,564		Bidirectional
Account, male (% age 15+)	1,828	0,037	0,272	0,728	-0,456	3,376	0,002	**	Y → X
Account, in labor force (% age 15+)	2,006	0,026	0,570	0,491	0,080	-0,626	0,535		Bidirectional
Account, out of labor force (% age 15+)	0,762	0,225	0,304	0,626	-0,322	2,174	0,036	**	No causality
Account, female (% age 15+)	1,418	0,082	0,950	0,680	0,271	-6,406	0,000	***	X → Y
Account, young adults (% ages 15-24)	0,885	0,191	0,248	0,676	-0,428	2,928	0,006	**	No causality
Account, older adults (% ages 25+)	2,066	0,022	0,788	0,724	0,064	-0,942	0,352		Bidirectional
Account, primary education or less (% ages 15+)	1,723	0,046	0,880	0,648	0,231	-3,633	0,001	***	X → Y
Account, secondary education or more (% ages 15+)	1,637	0,055	0,578	0,591	-0,013	0,122	0,904		Bidirectional
Account, income, poorest 40% (% ages 15+)	2,024	0,025	0,771	0,682	0,089	-1,150	0,257		Bidirectional
Account, income, richest 60% (% ages 15+)	1,598	0,059	0,592	0,715	-0,123	1,264	0,214		Bidirectional
Account, rural (% age 15+)	2,243	0,015	0,349	0,713	-0,364	2,757	0,009	**	Y → X
Financial institution account (% age 15+)	1,868	0,034	0,810	0,733	0,077	-1,201	0,237		Bidirectional
Financial institution account,male(% age 15+)	1,833	0,037	0,272	0,733	-0,461	3,435	0,001	**	Y → X
Financial institution account, in labor force(% age 15+)	2,002	0,026	0,604	0,706	-0,102	1,053	0,299		Bidirectional
Financial institution account, out of labor force (% age 15+)	0,747	0,230	0,312	0,639	-0,328	2,249	0,030	**	No causality
Financial institution account,female(% age 15+)	1,402	0,084	0,935	0,661	0,274	-5,616	0,000	***	X → Y
Financial institution account,young adults(% age 15-24)	0,897	0,188	0,264	0,688	-0,424	2,975	0,005	**	No causality
Financial institution account, older adults(% age 25+)	2,068	0,022	0,996	0,709	0,287	-15,069	0,000	***	X → Y
Financial institution account, primary education or less(% age 15+)	1,740	0,045	0,882	0,650	0,231	-3,664	0,001	***	X → Y
Financial institution account, seconday education or more(% age 15+)	1,669	0,051	0,619	0,617	0,002	-0,018	0,986		Bidirectional
Financial institution account,income,poorest 40% (% age 15+)	2,020	0,025	0,805	0,702	0,103	-1,475	0,148		Bidirectional
Financial institution account,income,richest 60% (% age 15+)	1,589	0,060	0,622	0,723	-0,101	1,094	0,280		Bidirectional
Financial institution account, rural(% age 15+)	2,235	0,016	0,547	0,720	-0,173	1,646	0,108		Bidirectional
Withdrawal in the past year (% with a financial institution account, age 15+)	1,339	0,096	0,534	0,219	0,316	-1,501	0,145		Bidirectional
Main mode of withdrawal: ATM (% with a financial institution account, age 15+)	-1,651	0,060	-0,392	-0,764	-0,372	1,895	0,079	*	Y → X
Main mode of withdrawal: bank teller (% with a financial institution account, age 15+)	2,627	0,010	0,575	0,858	-0,284	2,100	0,056	*	Y → X

Causal Paths between Digital Financial Inclusion and GDP

The second set of indicators we use are related with access to and use of digital technologies. It is argued that digital financial inclusion can enhance the ease of access to and availability of formal financial services (Rekha et al., 2021). With the advance of digital technologies, people can perform financial transactions easily through mobile phones. The results suggest that having a mobile money account kernel causes GDP. The data also shows that the causality runs from the share of female having a mobile money account to GDP. Thus, it is important to reduce the gender gap in financial inclusion. Similar to the previous analysis, we also observe that share of adults having a mobile account with primary education is also positively related with GDP. Because people with primary education may not have enough technical knowledge regarding the financial services, improving financial literacy may help these people to be integrated into the financial system which would in turn help increase GDP. Finally, the findings indicate that the share of adults having a mobile money account in rural areas kernel causes GDP as well.

In this category, we also analyze the causality between GDP and the digital payments made. The literature documents the importance of structural factors, such as information and communication technology (ICT) and policy related factors in improving financial inclusion (Rekha et. al., 2021). The kernel causality analysis shows that the share of adults made digital payments with primary education kernel causes GDP. However, causality runs from GDP to the share of adults in rural areas making digital payments. For the rest of the variables, we see bidirectional relation for most of the time indicating that an increase in GDP will be associated with increases in the use of digital platforms and vice versa. In terms of internet use, it is observed that the share of old people using internet kernel causes GDP. Similarly, an increase in the share of poor adults using internet leads to a rise in GDP. The results also suggest that an increase in GDP leads to a rise in the share of adults using internet, share of adults in rural areas using internet, share of older adults using internet, and share of adults using internet living in rural areas.

Table 2: Kernel causality between digital accounts and GDP

	PEARSON CORR		KERNEL CORR						
GDP per capita, PPP, constant 2017 int. 1000USD	t-stat1	p-value1	GMCyx	GMCxy	δ	t-stat2	p-value2		
Mobile money account (% age 15+)	1,463	0,083	0,815	0,095	0,720	-3,043	0,009	**	X → Y
Mobile money account, male (% age 15+)	1,310	0,106	0,823	0,069	0,754	-3,178	0,007	**	Indeterminite
Mobile money account, in labor force (% age 15+)	1,169	0,131	1,000	0,043	0,957	-7,752	0,000	***	Indeterminite
Mobile money account, out of labor force (% age 15+)	0,674	0,256	0,879	0,174	0,705	-3,632	0,003	**	Indeterminite
Mobile money account, female (% age 15+)	1,537	0,073	0,814	0,284	0,530	-2,572	0,023	**	X → Y
Mobile money account, young adults (% age 15-24)	0,272	0,395	0,992	0,080	0,912	-7,187	0,000	***	Indeterminite
Mobile money account, older adults (% age 25+)	1,800	0,047	0,433	0,183	0,250	-0,777	0,451		Bidirectional
Mobile money account, primary education or less (% age 15+)	1,451	0,084	0,992	0,675	0,318	-7,604	0,000	***	X → Y
Mobile money account, secondary education or less (% age 15+)	0,947	0,180	0,995	0,307	0,688	-7,540	0,000	***	Indeterminite
Mobile money account, income, poorest 40% (% age 15+)	1,303	0,107	0,988	0,325	0,663	-6,938	0,000	***	Indeterminite
Mobile money account, income, richest 60% (% age 15+)	1,645	0,061	0,402	0,127	0,276	-0,815	0,430		Bidirectional
Mobile money account, rural (% age 15+)	1,590	0,067	0,957	0,168	0,789	-5,410	0,000	***	X → Y
Made digital payments in the past year (% age 15+)	2,033	0,026	0,674	0,758	-0,084	0,845	0,406		Bidirectional
Made digital payments in the past year, male (% age 15+)	1,958	0,030	0,764	0,769	-0,005	0,057	0,955		Bidirectional
Made digital payments in the past year, in labor force (% age 15+)	1,779	0,043	0,661	0,756	-0,095	0,935	0,358		Bidirectional
Made digital payments in the past year, out of labor force (% age 15+)	1,102	0,140	0,887	0,611	0,276	-3,320	0,003	**	Indeterminite
Made digital payments in the past year, female (% age 15+)	1,641	0,056	0,546	0,745	-0,199	1,598	0,122		Bidirectional
Made digital payments in the past year, young adults (% age 15-24)	1,242	0,112	0,433	0,701	-0,268	1,779	0,087	*	Indeterminite
Made digital payments in the past year, older adults (% age 25+)	2,060	0,025	0,678	0,799	-0,121	1,310	0,202		Bidirectional
Made digital payments in the past year, primary education or less (% age 15+)	2,437	0,011	0,676	0,394	0,281	-1,743	0,093	*	X → Y
Made digital payments in the past year, secondary education or more (% age 15+)	1,735	0,047	0,752	0,746	0,006	-0,074	0,941		Bidirectional
Made digital payments in the past year, income, poorest 40% (% age 15+)	2,158	0,020	0,719	0,742	-0,023	0,252	0,803		Bidirectional
Made digital payments in the past year, income, richest 60% (% age 15+)	1,930	0,032	0,647	0,801	-0,155	1,589	0,124		Bidirectional
Made digital payments in the past year, rural (% age 15+)	2,344	0,013	0,739	0,706	0,032	-0,341	0,736		Bidirectional

Causal Paths between Barriers to Financial Inclusion and GDP

We now consider whether barriers to financial inclusion kernel cause GDP. Main barriers to financial inclusion identified in global findex database involve affordability, physical distance, lack of necessary documentation, having insufficient funds, trust in financial institutions and religious reasons. It is evident from the table that there is unidirectional causality running from affordability and having insufficient funds to GDP. Our findings are in line with the previous research. The literature suggest that the most two common reasons for not having a formal account is the lack of enough money to use one and the affordability of bank accounts because the account is too expensive (Demirgüç Kunt and Klapper, 2018). Therefore, policies directed at reducing the cost of

financial services such as transaction costs and fees may help increase both financial inclusion and GDP.

Table 3: Kernel causality between barriers to financial inclusion and GDP

	PEARSON CORR		KERNEL CORR						
GDP per capita, PPP, constant 2017 int. 1000USD	t-stat1	p-value1	GMCyx	GMCxy	δ	t-stat2	p-value2		
No account because financial institutions are too far away (% age 15+)	-0,921	0,188	-0,498	-0,539	0,041	-0,167	0,870		Indeterminite
No account because financial institutions are too far away (% without a financial institution account, age 15+)	-0,159	0,438	-0,498	-0,271	0,228	-0,718	0,488		Indeterminite
No account because financial services are too expensive (% age 15+)	-1,473	0,083	-0,983	-0,695	0,288	-5,505	0,000	***	X → Y
No account because financial services are too expensive (% without a financial institution account, age 15+)	-0,655	0,262	-0,320	-0,571	0,251	-0,865	0,405		Indeterminite
No account because of lack of necessary documentation (% age 15+)	-1,196	0,127	-0,326	-0,579	0,253	-0,880	0,398		Indeterminite
No account because of lack of necessary documentation (% without a financial institution account, age 15+)	0,847	0,207	0,238	0,070	0,167	-0,417	0,684		Indeterminite
No account because of lack of trust in financial institutions (% age 15+)	-1,478	0,083	-0,619	-0,673	0,054	-0,291	0,777		Bidirectional
No account because of lack of trust in financial institutions (% without a financial institution account, age 15+)	-1,073	0,152	-0,888	-0,622	0,265	-2,136	0,056	*	Indeterminite
No account because of religious reasons (% age 15+)	-1,720	0,056	-0,632	-0,748	0,116	-0,697	0,500		Bidirectional
No account because of religious reasons (% without a financial institution account, age 15+)	-0,952	0,180	-0,686	-0,476	0,211	-0,940	0,367		Indeterminite
No account because of insufficient funds (% age 15+)	-1,876	0,043	-0,988	-0,921	0,066	-3,491	0,005	**	X → Y
No account because of insufficient funds (% without a financial institution account, age 15+)	-1,305	0,108	-0,677	-0,906	0,229	-2,186	0,051	*	Indeterminite
No account because someone in the family has an account (% age 15+)	-0,697	0,250	-0,567	-0,477	0,090	-0,363	0,724		Indeterminite
No account because someone in the family has an account (% without a financial institution account, age 15+)	1,381	0,096	0,370	0,603	0,233	-0,860	0,408		Bidirectional
No account because of no need for financial services ONLY (% age 15+)	-0,960	0,178	-0,755	-0,688	0,067	-0,449	0,662		Indeterminite
No account because of no need for financial services ONLY (% without a financial institution account, age 15+)	-0,350	0,366	-0,762	-0,678	0,084	-0,557	0,589		Indeterminite

4. Conclusion and Policy Implications

In the MENA region, financial inclusion has been a policy agenda towards achieving higher growth rates and lowering poverty levels. Therefore, a literature has emerged analyzing the relationship between financial inclusion and GDP. However, most of the previous studies either use a financial inclusion index or focus on a small number of indicators for which time series data are available. Financial inclusion is a broader concept and the latest database provided by the World Bank makes it possible to identify many subcategories of financial inclusion. Analyzing the causal relationship between these financial inclusion indicators and GDP can provide a wealth of information useful for

designing effective policy solutions. While it is not possible to examine these relationships using the traditional Granger causality tests due to the data limitations, a recently developed advanced method, namely Kernel causality, provides a viable approach. Kernel causality, or instantaneous causality, states that a variable X instantaneously causes another variable Y if the present value of Y is better predicted when the present value of X is included in the prediction than if it is not. In this paper, we perform this analysis by employing a large number of measures of financial inclusion in order to identify the priority areas of improvement and facilitate effective policy making.

Our results offer important insights regarding the financial inclusion and growth nexus in the MENA region. First, we find that not all indicators of financial inclusion have a significant effect on GDP. Specifically, the results show that gender gap is an important factor and share of women having a formal account kernel causes economic growth. Furthermore, the results suggest that share of adults having an account with primary education positively affects GDP as well. Therefore, attempts to reduce gender gap in financial services and improving education level should be a priority for the governments. Also, promoting better education policies, supporting higher degree education and increasing financial literacy can provide important tools to increase financial inclusion as well. For example, in order to increase the number of women having an account, employers may be required to pay wages to the bank of women employees (Sing et. al., 2021).

Secondly, when the causality path is investigated between different income groups and GDP, it is seen that there generally exists a bidirectional relation. Similarly, we observe bidirectional causality between various indicators of digital financial inslusion and GDP growth, indicating that policies aimed at increasing economic growth may contribute to higher levels of financial inclusion.

Our results also unveil that having a mobile money account and the share of adults having a mobile account with primary education are also positively related with GDP. Hence, enhancing access to digital technologies should be placed on the center of policies aimed at improving financial inclusion. These can be in the form of developing a free high speed Internet infrastructure, encouraging digital device ownership as well as various incentives towards digital account usage. We also identify the relation between the main barriers to financial inclusion and GDP, and document that affordability and having insufficient funds are the two main culprints. Reducing the fees on certain financial services and making them more available may help increase financial inclusion. In this sense, policies should be developed to encourage competition in the banking system towards achieving to lower fees.

In conclusion, it is our understanding that exercising policies to enhance specific dimensions of financial inclusion can lead to higher economic growth in MENA countries. Furthermore, the findings of this research can help researchers develop better economic models based on the most concomitant determinants of financial inclusion, improving the quality of future empirical results.

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