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THE CAUSALITY BETWEEN FINANCIAL INCLUSION AND INCLUSIVE GROWTH: EVIDENCE FROM A NEWLY CONSTRUCTED INDEX IN EGYPT

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Abstract

Financial inclusion is one of the key enablers of driving economic growth, alleviating poverty, and consequently achieving inclusive growth. Although the relationship between financial inclusion and economic growth has been widely investigated, its relationship with inclusive growth remains unexplored. This paper examines the causality between financial inclusion and inclusive growth in Egypt during the period 2004-2022. The novelty of this study resides in constructing two composite indices using a Principal Components Analysis (PCA). The first composite index is for financial inclusion, while the second is a new multidimensional index for inclusive growth. The results reveal that the Inclusive Growth Index experiences an upward trend over the study period while the Financial Inclusion Index starts to increase in 2018. The results of the Toda-Yamamoto Causality Test show a bidirectional causality between financial inclusion and three of the sub-indices of inclusive growth as well as the overall inclusive growth index. The empirical evidence highlights that financial inclusion efforts will not achieve their targeted outcome unless a simultaneous inclusive growth strategy is conducted. Moreover, improving governance indicators is crucial to promoting inclusive growth.

Keywords: Financial inclusion, Inclusive growth, PCA, Causality.
JEL Classification: C22, C38, G2, O11, O15.

ملخص

يشكل الشمول المالي أحد العوامل الرئيسية التي تمكن من دفع عجلة النمو الاقتصادي، وتخفيف حدة الفقر، وبالتالي تحقيق النمو الشامل. على الرغم من أن العلاقة بين الشمول المالي والنمو الاقتصادي قد تم التحقيق فيها على نطاق واسع، إلا أن علاقتها بالنمو الشامل لم يتم استكشافها. تبحث هذه الورقة السببية بين الشمول المالي والنمو الشامل في مصر خلال الفترة 2004-2022. تكمن حداثة هذه الدراسة في بناء مؤشرين مركبين باستخدام تحليل المكونات الرئيسية (PCA). المؤشر المركب الأول مخصص للشمول المالي، بينما المؤشر الثاني هو مؤشر جديد متعدد الأبعاد للنمو الشامل. تكشف النتائج أن مؤشر النمو الشامل يشهد اتجاهًا تصاعديًا خلال فترة الدراسة بينما يبدأ مؤشر الشمول المالي في الزيادة في عام 2018. تُظهر نتائج اختبار Toda-Yamamoto Causality علاقة سببية ثنائية الاتجاه بين الشمول المالي وثلاثة من المؤشرات الفرعية للنمو الشامل بالإضافة إلى مؤشر النمو الشامل الإجمالي. وتبرز الأدلة التجريبية أن جهود الإدماج المالي لن تحقق نتائجها المستهدفة ما لم تنفذ استراتيجية نمو شاملة في آن واحد. وعلاوة على ذلك، فإن تحسين مؤشرات الحوكمة أمر حاسم لتعزيز النمو الشامل.

1. Introduction

Although fast economic growth is a crucial aspect of development, it is not always evenly distributed among all citizens. Hence, it is not merely a matter of achieving rapid growth; considering the growth pattern is important in reducing poverty and achieving sustainable growth (Ianchovichina et al., 2012). Economic growth that includes multiple sectors, creates new employment opportunities, and promotes equality is essential for a sustainable growth strategy. This is where the concept of inclusive growth (IG) comes into play. IG emphasizes the importance of having an equitable distribution of economic gains across the population, ensuring that everyone has access to opportunities and resources to improve their living standards.

There is no consensus on the definition of IG. In 2007, the Asian Development Bank (ADB) first proposed the new concept of IG, which focuses on creating opportunities and making them accessible to all. Ianchovichina et al. (2012) state that IG is "raising the pace of growth and enlarging the size of the economy, while leveling the playing field for investment and increasing productive employment opportunities." The Organisation for Economic Co-operation and Development (OECD) and the UN Environment Programme (UNEP) define IG as "growth which reduces poverty and inequality and benefits marginalized populations." Some definitions of IG distinguish it from pro-poor growth by incorporating non-income dimensions, such as health and educational status, employment conditions, and other aspects of life that can have a greater impact on well-being than income. The significance of non-income dimensions stems from their potential to offer opportunities and choices that are consequential for people's participation in economic life and society. Given its multidimensional nature, there is also no widely accepted measurement of IG. For instance, the ADB uses 35 indicators to measure four dimensions of IG: economic growth and employment opportunities; social inclusion; social safety nets; and good governance (ADB, 2012). Similarly, Cerra et al. (2021) measure IG through four pillars, which are benefit sharing, opportunity, participation, and empowerment. The United Nations Conference on Trade and Development (UNCTAD) has developed an IG index that includes 27 indicators to measure the four pillars of economy, living conditions, equality, and environment (UNCTAD, 2023).

As an emerging country, achieving IG is a critical imperative for Egypt, not just as an economic objective but also from social and political perspectives. According to World Bank data, the annual GDP growth rate has increased in Egypt since 2011 and reached 6.6 percent in 2022. However, the unemployment rates are still far above the world average. In addition, although Egypt's Human Development Index (HDI) score has recently improved, it lost around 29 percent of its score in 2021 when considering income inequality. Compared to some Middle Eastern North African (MENA) countries, Egypt's inequality-adjusted HDI score in 2021 was below that of Oman, Algeria, Jordan, and Tunisia. Therefore, as Egypt embarks on its ambitious development journey, ensuring that everyone benefits from economic progress is essential for sustainable growth.

Given the importance of IG, it is crucial to understand and investigate the factors that enhance its achievement. One of the key enablers of economic growth, poverty alleviation, and

consequently achieving IG is financial inclusion (FI). The concept of FI has become one of the most important and widespread financial concepts since the global financial crisis in 2008. The World Bank defines FI as "individuals and businesses having access to useful and affordable financial products and services that meet their needs for transactions, payments, savings, credit, and insurance and are delivered in a responsible and sustainable way." FI can play a role in achieving IG by facilitating savings, driving the efficient allocation of capital, and diversifying risks (Dabla-Norris et al., 2015; Sahay et al., 2015). In addition, the development of an inclusive financial sector can contribute to the non-income dimension of IG by promoting individuals' investments in their health, education, and business.

Several studies in the literature define FI in terms of several dimensions (Cámara and Tuesta, 2014; Ismael and Ali, 2021; Kebede et al., 2021; Sarma, 2008). For instance, Sarma (2008) proposes a multidimensional approach to compare the levels of FI across economies, incorporating information on the ease of access, availability, and usage of the formal financial system for all members of the economy. Access reflects the depth of outreach of financial services, such as the penetration of bank branches, while usage includes indicators such as the number of transactions per account and the number of borrowers. In capturing the essence of FI, the World Bank (2012) added the quality dimension, which describes clients' awareness and understanding of financial products, and whether these products match clients' needs. In its new version of the financial access survey, the International Monetary Fund (IMF) added other aspects such as affordability, awareness of financial services, and the financial access gender gap (IMF, 2020).

The performance of Egypt in FI measures, such as banking penetration, is below the average when compared to the world regions and some MENA countries such as Jordan, Lebanon, Qatar, and Saudi Arabia (Bibolov et al., 2022).[3] However, FI has become a priority in the country's Sustainable Development Strategy (SDS): Egypt Vision 2030. The SDS aims to establish an inclusive financial system that covers the needs of all segments of society, expand microfinance services, and promote digital financial services. In addition, digital banking has been gaining momentum in recent years. Between 2012 and 2021, the Middle Eastern digital banking market experienced sustained growth, rising at a 43 percent compound annual growth rate. According to the Digital Banking in the Middle East Report, the United Arab Emirates currently stands as the region's largest digital banking hub (BPC Group/Fincog, 2022). Egypt is also trying to keep pace with financial technology, where the number of fintech companies in the country increased by 5.5 times between 2017 and 2022 (CBE, 2023).

Although the relationship between FI and economic growth has been widely investigated, an analysis of the relationship between FI and IG has yet to be developed. Thus, this paper aims to explore the causal relationship between FI and IG in Egypt. The contribution of the present paper is threefold. First, we construct a new Inclusive Growth Index (IGI) for Egypt that incorporates four dimensions (economy, living conditions, equality, and governance) based on

[3] Banking penetration shows the penetration of the financial system among the population, which includes the number of borrowers, depositors, and bank accounts.

34 indicators during the period 2004-22. Second, we construct a Financial Inclusion Index (FII) based on nine indicators covering traditional and digital access as well as the usage of financial services during the period 2004-22. Third, we examine the causality between the constructed indices: the FII and the sub-indices as well as the overall index of IG.

The remainder of the paper is organized as follows. Section 2 presents the literature review, while section 3 discusses the methodological approach adopted in the construction of indices and tests the causality between them. Sections 4 and 5 present the FII and the IGI, respectively. Section 6 reports the causality results and discussion. Finally, section 7 concludes and provides policy implications.

2. Literature review

The role of an efficient financial sector in enhancing economic growth goes back to Bagehot (1873), who suggests the basis of finance-led growth, highlighting the importance of an efficient financial sector to enhance economic growth by pooling resources and allocating them to the most profitable enterprises. Similarly, Schumpeter (1911) argues that the financial system plays a positive role in enhancing economic growth, where the provision of sufficient financing facilities permits the economy to rise.

Several empirical studies have recently investigated the relationship between FI and economic growth. For instance, Lenka and Sharma (2017) construct an FII for India using a Principal Component Analysis (PCA) and find that FI has a positive effect on economic growth both in the long and short run. For a panel set of developed and developing countries, Sethi and Acharya (2018) conclude that there is a bidirectional causality between FI and economic growth. Similarly, Azimi (2022) reaches the same conclusion that FI positively affects economic growth and that there is bidirectional causality between the two variables.

The studies that analyzed the effect of FI on economic growth in Egypt have reached inconclusive results. On the one hand, Wafik and Omar (2022) conclude that FI (measured by total deposits and loans) had a positive effect on economic growth during the period 1980-2019. On the other hand, Mansour and Abdalla (2023) find that FI (measured by the number of ATMs) had no significant impact on economic growth for the period 2004-19. By examining the effect of the sub-dimensions of FI on economic growth, Ifediora et al. (2022) use a composite index of FI and discover that the availability dimension of FI has a positive significant impact on economic growth in Sub-Saharan Africa while the effect of the usage dimension is not significant.

It is important to note that a prerequisite for the positive effect of FI on economic growth is the presence of a certain level of financial development beforehand. In the case of the presence of a fragile financial system, the effect of inclusion on growth is not significant (Silue, 2021). At the same time, financial development benefits economic growth up to a certain threshold. The

benefits of FI to economic growth decrease as financial depth increases.[4] Financing a greater share of investment with bank credit, increasing the number of households with bank accounts and credit cards, and using accounts to receive wages have a strong link to long-term economic growth and poverty reduction. Mobile money services act as a reliable driver of digital FI that increases long-term consumption, and they have helped reduce extreme poverty in Kenya (Suri and Jack, 2016). However, a large increase in financial depth is not necessarily a good thing; when financial sectors deepen too fast, it often leads to crises and instability, especially without adequate regulation and supervision (Sahay et al., 2015). Countries with high ratios of private sector credit to GDP such as Spain, the Netherlands, Portugal, the United Kingdom, Luxembourg, and Switzerland have had major crisis episodes since 2008.

Most of the previous literature has presented evidence that high levels of FI are associated with high levels of economic growth. However, the relationship between FI and IG is not well understood. The transmission of FI to IG can be illustrated in three steps. First, an inclusive financial system makes it easier for individuals to access financial services and it also helps mobilize the savings of the aging population for investment, thereby promoting the effective allocation of productive resources (Aghion and Bolton, 1997). Second, FI increases access to credit, which enables existing businesses to expand, enhances entrepreneurial possibilities, and helps generate jobs (Audi et al., 2019). Third, when the poor who are unemployed are given the opportunity, they become successful economic agents in the country's growth process. This eventually raises the income and consumption of individuals (Liu et al., 2022; Sahu, 2013), hence reducing both poverty and inequality, in addition to promoting IG (Chandran, 2011).

Few studies examined the relationship between FI and indicators of IG. For instance, Neaime and Gaysset (2018) study the effect of FI (measured by number of banks) on income inequality (measured by the Gini index) and poverty (measured by growth rate of poverty) in a sample of MENA countries. They find a significant negative effect of FI on income inequality but no significant effect on poverty. A similar conclusion regarding the positive contribution of FI in reducing income inequality is shown by Turegano and Herrero (2018). Wang et al. (2023) construct three indices: FI, information and communication technology (ICT), and IG using a PCA for a sample of 10 African countries and find that both ICT and FI have a positive significant impact on IG.

Our paper contributes to the above literature by investigating the causal relationship between FI and IG in Egypt. We examine the causality between these two variables using newly constructed indices, and, more importantly, we attempt to identify the direction of causality not only between FI and the overall IGI but also between FI and the sub-indices of IG to gain a better understanding of the role of FI in all aspects of IG.

[4] According to the World Bank (2016), financial depth is "the size of banks, other financial institutions, and financial markets in a country, taken together and compared to a measure of economic output."

3. Data and methodology

In this section, we first identify the most important indicators and the methodology used to construct the FII and the IGI in Egypt during the period 2004-21. We then explain the method of testing the causality between the two indices.

3.1 Construction of the FII

3.1.1 Indicators

FI is a complex concept determined by the interplay of several variables. Access and usage are the most commonly used concepts to monitor the progress made in deepening the FII (Beck et al., 2007; Cámara and Tuesta, 2014; Kebede et al., 2021; Sarma, 2008). The FII constructed in this paper includes nine variables that can be grouped into two dimensions as shown below in Table 1. The first is the traditional and digital access dimension. The indicators widely used in this regard refer to the number of ATMs available, in addition to the number of bank branches (Roa et al., 2014). The first indicator works better since the use of financial services greatly depends on geographic availability, which is easier and more economical to achieve through ATMs or electronic banking. Some recent studies have begun to incorporate digital indicators to measure FI (Cámara and Tuesta, 2014; Ismael and Ali, 2021; Khera et al., 2022; Maino et al., 2019; Sahay et al., 2020). These indicators include accessing financial services through mobile phones and using mobile accounts to make or receive payments. For instance, Ismael and Ali (2021) for Egypt and Khera et al. (2022) for some developing countries construct both traditional and digital FIIs. The incorporation of digital indicators provides a more comprehensive understanding of FI, enabling us to evaluate how technology supports FI. In this paper, we include digital indicators such as mobile subscriptions and using the Internet to access financial services (Khera et al., 2022). The second is the usage dimension. To assess the extent of usage of formal financial services, three indicators are utilized: outstanding deposits with commercial banks, outstanding loans from commercial banks, and the number of borrowers from commercial banks. Practically, the major challenge that affects the choice of indicators is data availability. Due to the lack of data for the whole period of our study, we could not include digital indicators for the usage dimension.

Table 1. Variables Included in Egypt's FII

Dimension	Variable	Source
Access	**Traditional Access**	Financial Access Survey (FAS), IMF
	1. Number of commercial bank branches per 1,000 km2	
	2. Number of commercial bank branches per 100,000 adults	
	3. Number of ATMs per 1,000 km2	
	4. Number of ATMs per 100,000 adults	
	Digital Access	World Development Indicators (WDI)
	5. Mobile cellular subscriptions (per 100 people)	
	6. Individuals using the Internet (% of population)	
Usage	7. Number of borrowers from commercial banks per 1,000 adults	FAS, IMF
	8. Outstanding deposits from commercial banks (% of GDP)	
	9. Outstanding loans from commercial banks (% of GDP)	

3.1.2 Methodology

To compute a measure of FI in Egypt, we use a PCA, which is a statistical technique widely used to reduce the number of variables in a dataset into a smaller set of uncorrelated factors, called principal components (PCs), where each component is a linear weighted combination of the initial variables (Jolliffe and Cadima, 2016; Krishnan, 2010). Unlike the non-parametric approaches that typically assign ad hoc weights on variables in creating an index, the PCA, as a parametric method, determines the weights of variables and dimensions endogenously (Tram et al., 2021), resulting in a more robust and accurate assessment.

To create a single FII, the methodological steps proceed as follows. First, we test for the suitability of data to conduct the PCA using two measures: the Kaiser-Meyer-Olkin (KMO) test, which measures the sampling adequacy, and Bartlett's sphericity test, which examines whether variables are orthogonal. The KMO measure takes values from zero to one, where the minimum acceptable value for factor analysis is 0.5 (Cerny and Kaiser, 1977; Field, 2013).

Second, upon satisfaction with the above two tests, the factor or component score coefficients are estimated using the regression method as follows:

$$PC_1 = \beta_1 X_{1t} + \beta_2 X_{2t} + .. + \beta_3 X_{3t} + e_t \qquad (1)$$

where PC_i is the estimated component /factor score, X_1, X_2, … X_n are the indicators of FI as explained in Table 1, and e is the error term.

The order of the components is determined by the amount of variation in the original variables explained by each component such that the first component explains the largest amount of variation. Therefore, the nine variables mentioned above can be reduced into one index explaining most of the variation of the data. The choice of the number of PCs to be retained depends on the explained percentage of total variation in the data and the eigenvalue. The eigenvalue represents the variance of each PC, where, according to Kaiser's rule, the eigenvalue components larger than one are extracted (Kaiser, 1960). In addition, it is generally recommended that the cutoff percentage of variation explained by components be at least 70-75 percent (Jolliffe, 2002). Some other studies recommend that the components extracted should explain more than 60 percent of the variance (Chadha and Chadda, 2020).

Third, a Non-Standardized Financial Inclusion Index (NSFII) is constructed by summing the extracted factor scores weighted by their proportion of percentages explaining the total variation (Chadha and Chadda, 2020; Krishnan, 2010; Sekhar et al., 1991), as follows:

$$NSFII_t = \frac{\sum_j^p \gamma_j PC_j}{\sum_j^p \gamma_j} \qquad (2)$$

Where γ_j is the proportion of the variation of the j^{th} PC.

Fourth, to facilitate interpretation, a standardized FII taking values between zero and one is calculated as follows:

$$FII_t = \frac{NSFII_t - Min\ (NSFII)}{Max\ (NSFII) - Min\ (NSFII)} \qquad (3)$$

3.2 Construction of the IGI

3.2.1 Indicators

There is no agreement on the dimensions and indicators used to measure IG. In our paper, we mainly rely on three references. The first is the IGI developed by the UNCTAD and the Eurasian Economic Commission (EEC), which considers three main pillars: economy, living conditions, and equality (UNCTAD and EEC, 2019). Each pillar includes several indicators. The economy pillar includes variables such as GDP per capita, labor productivity, employment rate, and exports of goods and services. The living conditions pillar includes, among others, school enrollment and coverage of essential financial services. The Gini index, ratio of female to male employment rate, and poverty headcount ratio are some of the indicators used to account for inequality. The second is the set of ADB IG indicators (ADB, 2012; McKinley, 2010), which is grouped into four dimensions: growth and expansion of economic opportunities, social inclusion, social safety nets, and governance indicators. Third, we use some indicators used in the IGI constructed by Bibolov et al. (2022), where eight sub-indices "1) income inequality, 2) access to education, 3) access to health services, 4) financial inclusion, 5) labor market inclusion, 6) private sector inclusion, 7) gender inclusion, and 8) quality of governance" are underlying the overall index.

Our IGI is composed of four dimensions:

1. **Economy**, which includes indicators measuring economic growth, employment, and labor productivity. To gain insights into the underlying drivers of economic growth, we also include the value-added of different sectors of the economy (McKinley, 2010).
2. **Living conditions** include indicators of infrastructure, health, and education.
3. **Equality**, including income inequality and gender equality.
4. **Governance**

All details of variables and sources of data used are presented in Table 2.

Table 2. Variables included in Egypt's IGI

Dimension	Economy	Living Conditions
Indicators	1. GDP per capita (constant 2015 USD) 2. Adjusted net national income per capita (constant 2015 USD) 3. Agriculture, forestry, and fishing, value-added (constant 2015 USD) 4. Industry (including construction), value-added (constant 2015 USS) 5. Services, value-added (constant 2015 USD) 6. GDP per person employed (constant 2017 PPP USD) 7. Employment to population ratio, 15+, total (%) (modeled ILO estimate) 8. Self-employed, total (% of total employment) (modeled ILO estimate) 9. Exports of goods and services (% of GDP) 10. Electricity Consumption Per Capita MWH/Capita	1. Fixed broadband subscriptions (per 100 people) 2. People using safely managed sanitation services (% of population) 3. Life expectancy at birth, total (years) 4. Mortality rate, under 5 (per 1,000 live births) 5. Immunization, DPT (% of children aged 12-23 months) 6. Percentage of expenditures on health to public expenditure of the state 7. School enrollment, primary (% gross 8. Expected years of schooling (years) 9. Percentage of expenditures on education to public expenditure of the state
Sources	All variables are from the World Development Indicators (WDI), World Bank, except No. 10, which is from the International Energy Agency (IEA).	All variables are from the World Development Indicators (WDI), World Bank, except No. 6 and No. 9, which are from Central Agency for Public Mobilization and Statistics (CAPMAS), and No. 8, which is from Human Development Report data (HDI).
Dimension	**Equality**	**Governance**
Indicators	1. Gini Index 2. Employment to population ratio, 15+, female (%) (modeled ILO estimate) 3. Employment in services, female (% of female employment) (modeled ILO estimate) 4. Ratio of female to male youth unemployment rate (% ages 15-24) 5. Employment, youth total (% of total labor force aged 15-24) 6. Ratio of female to male labor force participation rate (%) (modeled ILO estimate) 7. Share of seats in parliament, female (% held by women) 8. Ratio of female to male mean years of schooling 9. Ratio of gross national income per capita (2017 PPP$) of female to male	1. Control of corruption 2. Government effectiveness 3. Political stability and absence of violence 4. Regulatory quality 5. Rule of law 6. Voice and accountability
Sources	No. 1: World Income Inequality Database No. 2, 3, 4, 5: World Development Indicators (WDI) No. 6, 7: UN Women https://data.unwomen.org/ No. 8, 9: Calculated by the authors based on data from the Human Development Report	All variables are from Worldwide Governance Indicators (WGI).

3.2.2 Methodology

The IGI is constructed using the PCA, therefore the same steps explained in subsection 3.1.2 are followed. However, in constructing the IGI, we use a two-stage PCA (Cámara and Tuesta, 2014; Nagar and Basu, 2002). In the first stage, the PCA is applied to create four sub-indices: economy, living conditions, equality, and governance (ECO, LIVING, EQU, and GOV). In the second stage, the PCA is applied again, where we use the previously constructed sub-indices as indicators to construct the overall IGI. Two advantages stem from this approach. First, given a large number of indicators (34 indicators in our case), it is not preferred to estimate the overall index directly to avoid biases that might occur due to highly correlated variables (Chadha and

Chadda, 2020; Mishra, 2007). Second, analyzing the trend of the four dimensions separately is more informative for policymaking in assessing IG.

Estimating the four sub-indices (ECO, LIVING, EQU, and GOV) will follow the same steps as in equations 1 to 3. Then, the overall IGI will be similarly estimated with the four sub-indices as explanatory variables as follows:

$$IGI_t = \omega_1 ECO_t + \omega_2 LIVING_t + \omega_3 EQU_t + \omega_4 GOV_t + \varepsilon_t \qquad (4)$$

where t is year, ε is the error term.

3.3 Causality

Testing the causality between FI and IG proceeds through the following steps. As a preliminary step, the stationarity properties of the data are investigated using the Augmented Dickey-Fuller (ADF) test in addition to the Phillips-Perron unit root tests, which use a nonparametric method to consider the probability of serial correlation in the residuals. However, Perron (1989) shows that failure to allow for an existing break leads to a bias that reduces the ability to reject a false unit root null hypothesis. To overcome this, Perron proposes allowing for a known or exogenous structural break in the ADF tests. Therefore, a modified Dickey-Fuller test that allows for levels and trends that differ across a single break date is utilized. The testing framework follows the work of Perron (1989), Banerjee et al. (1992), and Vogelsang and Perron (1998).

If the variables are found stationary at level, the traditional Granger non-causality test is utilized; however, if some variables are stationary at first difference, the modified procedure of Toda and Yamamoto (1995) is used. The non-Granger causality test of Toda and Yamamoto (1995) avoids the problems associated with the ordinary Granger causality test when the series are non-stationary. The basic idea of the Toda and Yamamoto approach is to augment the correct VAR order (p) by the maximal order of integration of the variables (m), and then estimate the augmented VAR that guarantees the asymptotic distribution of the Wald statistic. Three stages are involved in implementing those procedures. The first stage is to determine the maximum order of integration (m) of the variables in the system. The second stage involves estimating a Vector Auto Regressive (VAR) model of the variables in their levels with optimal lag length determined based on any of the information criteria, such as the Akaike Information Criterion (AIC), or the Schwarz Information Criterion (SIC), therefore making sure that the VAR is well-specified.[5] In the third stage, the favored VAR model is constructed, and the additional m lags of each variable are inserted into each equation. The modified Wald procedure has been used to test the VAR (k) model for causality where k = (p + m).

Dummy variables representing the structural breaks in variables taking the value of one on the break date and zero otherwise are added to the causality test equation. Following Yamada and

[5] The VAR residual LM test is used to check for autocorrelation and the estimated model is checked for the stability conditions by finding the inverse root.

Toda (1998), the Toda-Yamamoto causality test can be used in a bivariate setting by fitting the following augmented VAR (p+m) model:

$$\log(FI)_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} \log(FI)_{t-i} + \sum_{i=p+1}^{p+m} \alpha_{2i} \log(FI)_{t-i} + \sum_{i=1}^{p} \beta_{1i} \log(X)_{t-i} + \epsilon_{1i} \sum_{i=p+1}^{p+m} \beta_{2i} \log(X)_{t-i} + \epsilon_{1i} \quad (5)$$

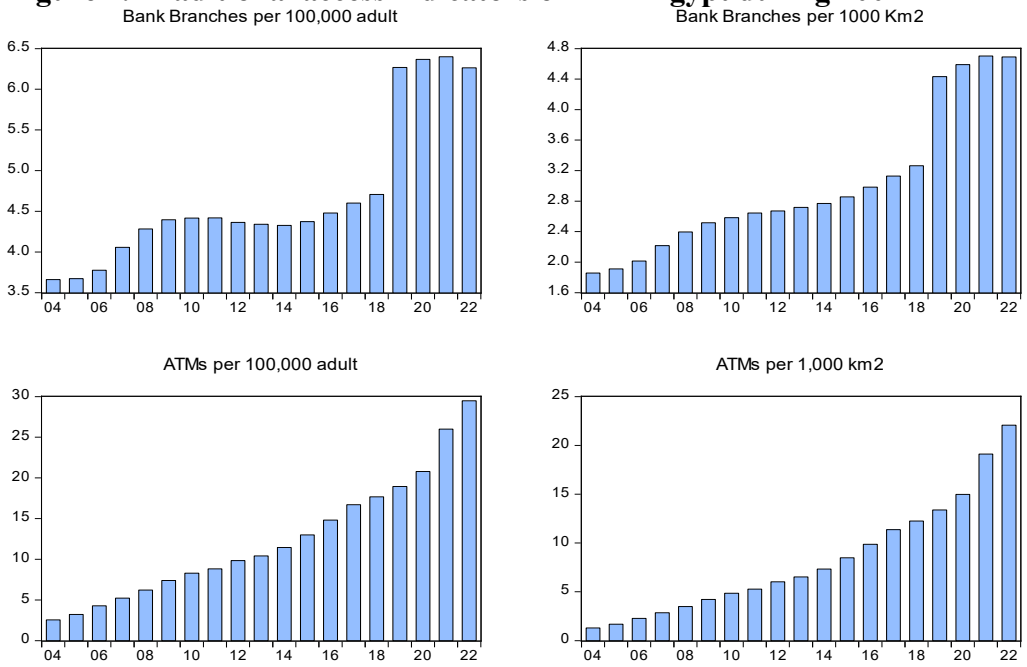
$$\log(X)_t = \theta_0 + \sum_{i=1}^{p} \theta_{1i} \log(X)_{t-i} + \sum_{i=p+1}^{p+m} \theta_{2i} \log(X)_{t-i} + \sum_{i=1}^{p} \omega_{1i} \log(FI)_{t-i} + \epsilon_{1i} \sum_{i=p+1}^{p+m} \omega_{2i} \log(FI)_{t-i} + \epsilon_{1i} \quad (6)$$

4. FII

4.1 Analysis of FI indicators in Egypt

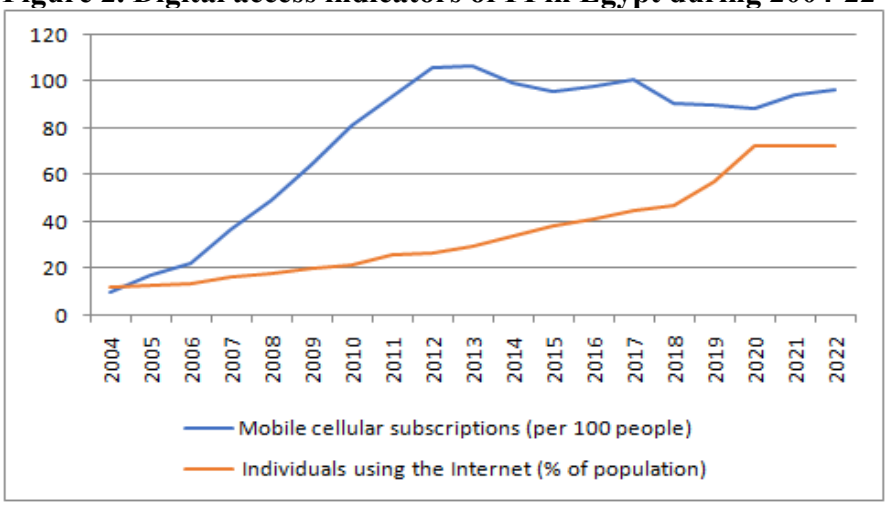
Before analyzing the constructed FII, it is imperative to first examine the trend of the FI indicators, which are explained in the previous section in Table 1, to gain a better understanding of the overall index. The banking density (measured by bank branches per 100,000 adults) was considered low until 2018, when residents in most of rural Egypt had no access to bank branches or even ATMs. According to World Bank data, the share of the population in rural areas was 57 percent on average, and in its rural areas in Upper Egypt, the poverty rate reached nearly 43 percent. The situation has improved thereafter by increasing the number of branches and expanding the reach of ATM networks. The number of commercial bank branches per 100,000 adults increased by 33 percent (from 4.71 in 2018 to 6.27 in 2019), while the number of commercial bank branches per 1,000 square kilometers increased by 36 percent (from 3.26 in 2018 to 4.43 in 2019) as shown in Figure 1. To increase the number of ATMs in line with the global average, the CBE launched an initiative in 2020 to set up an additional 6,500 ATMs across the country's smaller towns and rural areas by December 2021. Moreover, the launch of Meeza cards in November 2021 aimed at fostering FI and facilitating the transition to a cashless society. The government distributed 21 million Meeza cards and supplied the market with 700,000 ATMs where Meeza cardholders can withdraw money. Therefore, the number of ATMs per 100,000 adults increased by 56 percent from 18.9 in 2019 to 29.5 in 2022.

Figure 1. Traditional access indicators of FI in Egypt during 2004-22



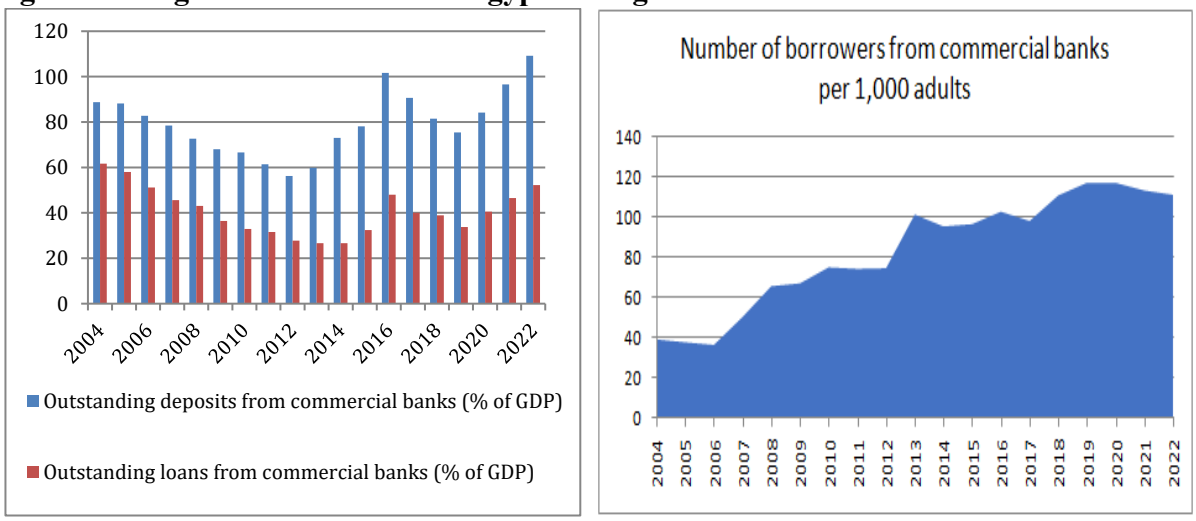
Regarding digital FI access, Egypt made significant progress in terms of regulatory policies promoting technology in retail banking, making banking services more accessible to unbanked consumers, small and medium enterprises, and people living in remote areas. Furthermore, the high percentage of the youth population has driven consumer demand for digital banking up. There were a reported 90.27 mobile subscriptions per 100 inhabitants in Egypt in 2019, up from 9.86 in 2004 as shown in Figure 2. The COVID-19 pandemic rapidly transformed Egypt's banking landscape; before the pandemic, only about half of the country's banks offered mobile banking services to their customers due to regulatory concerns over poor security practices. With customers kept away by lockdowns, local banks invested heavily in their digital infrastructure, accelerating digitalization, and providing a wide range of mobile services. By the end of 2020, 32 out of 38 banks offered Internet banking services and 28 had been granted mobile banking licenses. The number of mobile wallet users reached 16.3 million and mobile subscriptions reached 94.68 in 2021. Figure 2 shows the dramatic increase in the number of individuals using the Internet (from 12 percent in 2012 to 72 percent in 2022). However, the Oxford Business Review (2021) highlights the Egyptian economy's heavy reliance on cash as the informal sector represents about 50 percent of the economic activities, while cash payments constitute almost 55 percent of online purchases.

Figure 2. Digital access indicators of FI in Egypt during 2004-22



The usage of financial services, represented by outstanding deposits with commercial banks (percent of GDP) and outstanding loans from commercial banks (percent of GDP), experienced a downward trend from 2004 to 2014, then increased thereafter. The latest data from 2022 indicates that outstanding loans from commercial banks (percent of GDP) nearly doubled over the last decade, increasing from 26.6 percent in 2013 to 52.2 percent in 2022. The third indicator used in this regard is the number of borrowers from commercial banks per 1,000 adults, which experienced an upward trend throughout the study period, increasing from 29.07 in 2004 to 110.6 in 2022.

Figure 3. Usage indicators of FI in Egypt during 2004-22



4.2. Constructed FII

As mentioned in section 2, we start by checking the suitability of data to conduct the PCA. We use IBM SPSS Statistics 29 software in all steps for constructing the indices.[6] The results of

[6] One of the limitations of dealing with many variables when constructing the FI or IG indices is that we find few data are missing. Hence, to deal with this we replace missing data using SPSS either by linear interpolation (if missing data is in the middle of the time series) or linear trend at point (if missing data is in the last year of the time series).

the KMO and Bartlett's tests are reported in Table 3, where the value of the KMO is 0.740 (>0.5) and the significance of Bartlett's test is less than 0.001 (i.e., less than the critical value of 0.05), indicating that the correlation matrix is not identified. Hence, there is a relationship between the variables that allows us to conduct a factor analysis.

Table 3. KMO and Bartlett's tests for FI

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**0.740**
Bartlett's Test of Sphericity	**Approx. Chi Square**	414.663
	df	36
	Sig.	<0.001

Source: Compiled by the authors using SPSS.

The results of the eigenvalues and factor loadings are presented in Table 4.[7] According to the results, only the first two components show an eigenvalue larger than one, with the first principal component (PC1) accounting for 70 percent of the variance of the data, followed by 24 percent by the second principal component (PC2). Hence, these two components account for 92 percent of the total variance in our FII. Based on the reported factor loadings in Table 4, all 'access' indicators show high positive factor loadings for the first component with the highest factor loadings corresponding to the usage of the Internet and the number of ATMs per 100,000 adults. For the second component, two indicators of 'usage' show high factor loadings, where the factor loading of outstanding loans is higher than outstanding deposits. Generally, a large absolute value of factor loading implies a larger weight of this variable in influencing the component. Hence, we can interpret the first component as a measure of access, while the second component can be interpreted as a measure of usage since the first component is dominated by the access indicators.

Table 4. Rotated component matrix of FII

Indicators	**PC1**	**PC2**
Use Internet	**0.992**	0.051
ATM/Adult	**0.991**	0.048
ATM/Km	**0.987**	0.092
Branches/Km	**0.977**	0.016
Branches/Adult	**0.934**	0.030
Borrowers	**0.907**	-0.330
Mobile Subscription	**0.684**	-0.651
Outstanding Loans	-0.126	**0.984**
Outstanding Deposits	0.464	**0.823**
Initial Eigenvalues		
Total	6.305	2.718
% of variance	70.055	24.195
Cumulative %	70.055	**94.251**

Source: Compiled by the authors using SPSS.
**Extraction Method: PCA.*
** Rotation Method: Varimax with Kaiser Normalization*
**Rotation converged in three iterations.*

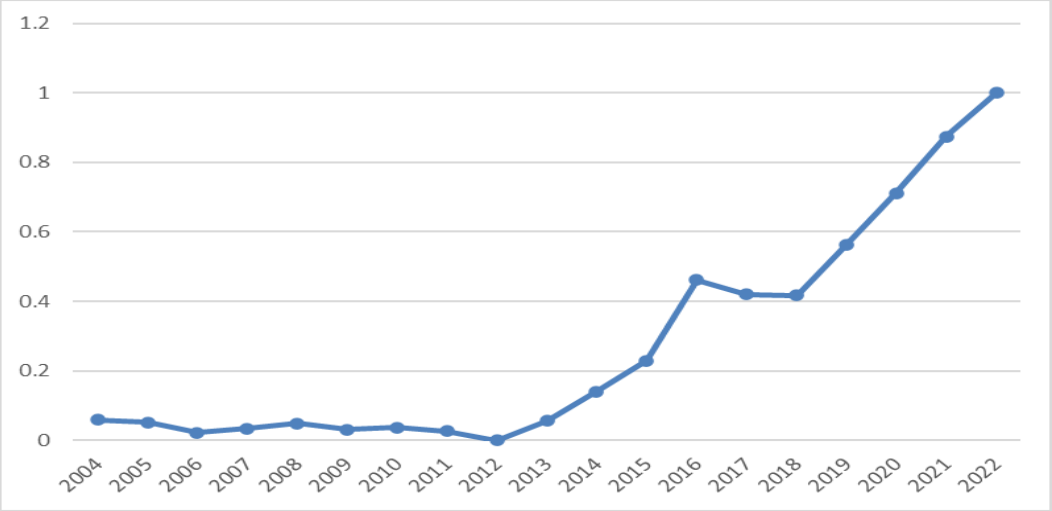
[7] Since variables are not standardized, we use the correlation matrix in conducting the PCA.

Given the results in Table 4, equation 2 can be written as:

$$\text{NSFII}=\frac{70.005}{94.251}(PC_1\ score)+\frac{24.195}{94.251}(PC_2\ score).$$

After standardization, the constructed FII illustrated in Figure 4 indicates that Egypt had a low level of FI ($0 \leq \text{FII} \leq 0.5$) during the period 2004-16. This was mainly due to the relatively low levels of all access indicators considered, mainly the geographic access (number of ATMs and number of commercial bank branches per 1,000 square kilometers). In addition, the percentage of outstanding deposits and loans declined during this period. However, there has been great improvement since 2018, wherein the FII increased by around 140 percent from 2018-22.

Figure 4. FII in Egypt (2004-22)



Source: Authors' calculations.

5. IGI

In this section, we construct the four sub-indices of IG, after which the overall IGI is estimated. We start by checking the suitability of data for conducting the PCA for all indices. Based on Table 5, both the KMO test and Bartlett's sphericity test are satisfied.

Table 5. KMO and Bartlett's Tests for the IGI

		Economy	Living Conditions	Equality	Governance	Overall IGI
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.824	0.779	0.733	0.549	0.749
Bartlett's Sphericity Test	**Approx. Chi Square**	495.349	266.966	162.327	70.132	93.601
	df	45	36	36	15	6
	Sig.	<0.001	<0.001	<0.001	<0.001	<0.001

Source: Compiled by the authors using SPSS.

5.1 Economy dimension

Table 6 shows that PC1 explains around 83 percent of the variation of the data with an eigenvalue larger than eight. The factor loadings of the first two PCs with an eigenvalue larger than one show that PC2 has only one variable with a large factor loading (electricity consumption with 0.73), while most of the other variables are captured by PC1. Given that PC1

explains a large satisfactory percentage of the variation of the data, we extract PC1 only as the economy index.

PC1 shows that the highest factor loading is associated with the agricultural and service sectors' value-added (0.995 each), followed by industry's value-added, GDP per capita, and labor productivity. Most of the variables have very close factor loading, implying that there is no specific indicator that dominates this index. However, the lowest factor loading is for electricity consumption with 0.651, indicating a smaller weight for this indicator in the index.

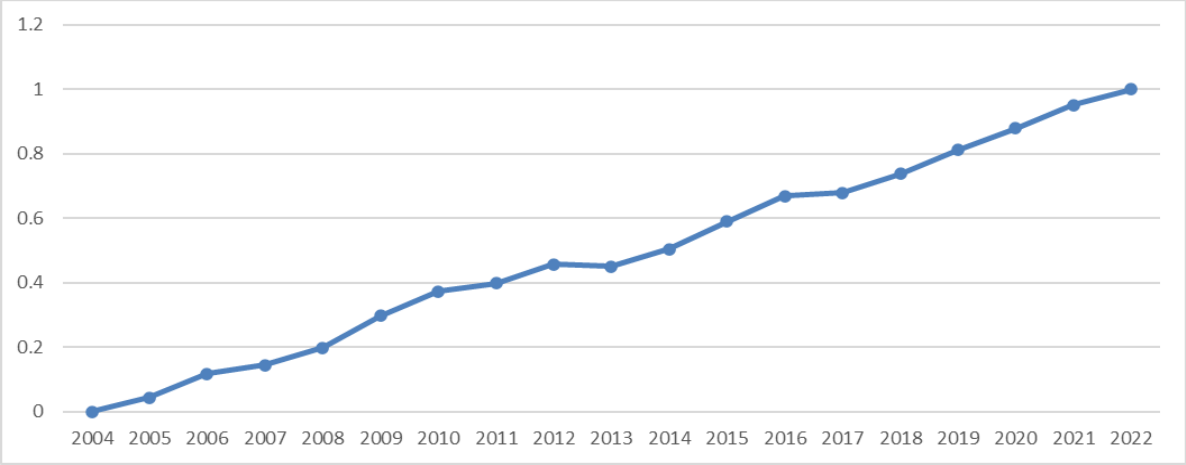
Table 6. Component matrix of economy sub-index

Indicators	**PC1**
Agriculture VA	0.995
Service VA	0.995
Industry VA	0.980
GDP per Capita	0.979
GDP per Person Employed	0.976
Adj NNI per Capita	0.965
Self-Employment	-0.926
Exports of G&S	-0.865
Employment	-0.694
Electricity Consumption	0.651
Initial Eigenvalues Total	8.298
% of variance	82.979
Cumulative %	**82.979**

Source: Compiled by the authors using SPSS.
**Extraction Method: PCA.*
** One component is extracted.*

The economy sub-index illustrated in Figure 5 has an increasing trend over the study period. This was mainly driven by the increasing trend of the sectoral value added, GDP per capita, and labor productivity. On the other hand, the employment ratio, percentage of self-employed, and exports of goods and services were all declining during this period, and hence negatively correlated with the economy index.

Figure 5. Economy sub-index in Egypt (2004-22)



Source: Authors' calculations.

5.2 Living conditions

The results of constructing the living condition sub-index are reported in Table 7 and Figure 6.

Table 7. Component Matrix of Living Conditions Sub-index

Indicators	**PC1**
People Using Safely Managed Sanitation	0.993
Expected Years of Schooling	0.986
Under 5 Mortality Rate	-0.986
Life Expectancy at Birth	0.942
Fixed Broadband Subscription	0.940
Public Expenditure on Education	-0.871
Children Immunization DPT	-0.768
School Enrollment, Primary (Gross)	0.730
Public Expenditure on Health	0.351
Initial Eigenvalues Total	6.705
% of variance	74.504
Cumulative %	**74.504**

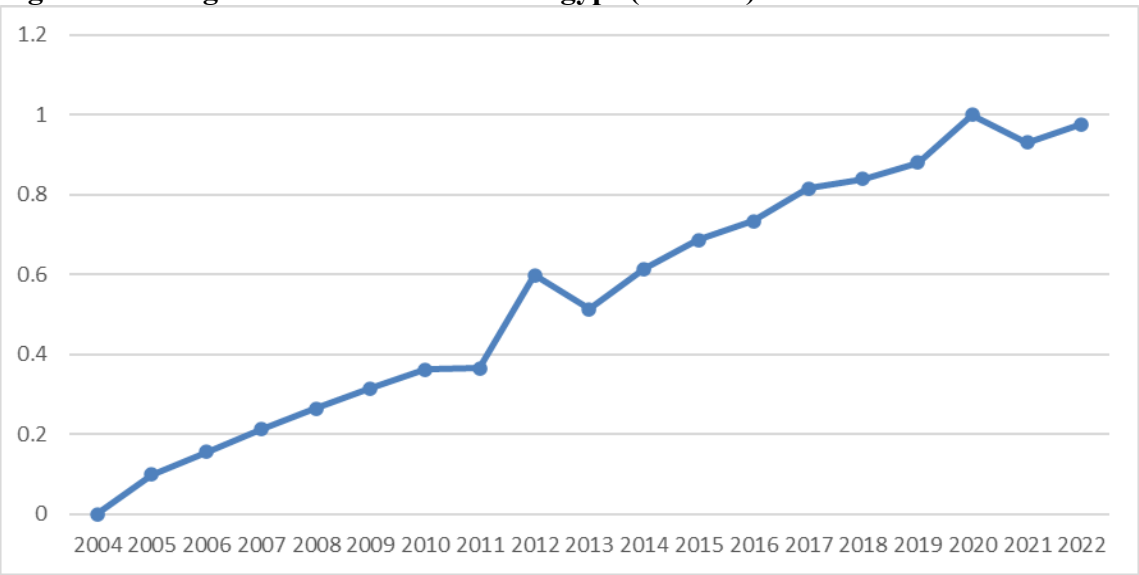
Source: Compiled by the authors using SPSS.
**Extraction Method: PCA.*
** One component is extracted.*

According to the extracted results, only the first two PCs have an eigenvalue larger than one. However, similar to the previous index, we extract PC1 only since all variables' factor loadings under PC2 are less than 0.4 except for public expenditures on health. Hence, given the satisfactory percentage of variation explained by PC1 (which is 74.5 percent), only PC1 will be used to determine the living conditions sub-index.

The living condition sub-index has an increasing trend in Egypt during the period 2004-22. This was mainly driven by the two infrastructure indicators (safely managed sanitation with 0.993, and fixed broadband subscription with 0.94). Health status, measured by life expectancy at birth and the mortality rate of those under five, improved during the study period and contributed positively to the living condition index. However, public expenditures on health have slightly increased during this period; its factor loading is the smallest (only 0.351).

Regarding the education indicators, expected years of schooling have the largest factor loading, followed by primary school enrollment, and both show an increasing trend during this period. In contrast, public expenditure on education has been decreasing and hence affects living conditions negatively during this period.

Figure 6. Living condition sub-index in Egypt (2004-22)



Source: Authors' calculations.

5.3 Equality sub-index

Based on the results in Table 8, two PCs have eigenvalues larger than one. The percentage of variance explained by the first and the second components is 57 percent and 22 percent, respectively. The two components will be retained to construct the equality index. The first component is dominated by the female status in the labor market, the gender gap in education, and income inequality. Female employment in the service sector (as a percentage of female employment), the ratio of female to male mean years of schooling, and the share of parliament seats held by women capture the largest weights in the equality dimension, where the factor loadings of the three indicators are 0.916, 0.903, and 0.892, respectively. The factor loading corresponding to income inequality is 0.527. The second component, which contributes by a smaller share to the equality index, is dominated by the gender gap in youth unemployment (measured by the ratio of female to male youth unemployment), followed by the gender gap in income (measured by the ratio of female to male gross national income per capita), with a factor loading of 0.934 and 0.865, respectively. This is followed by the percentage of employed youth and the gender gap in labor force participation.

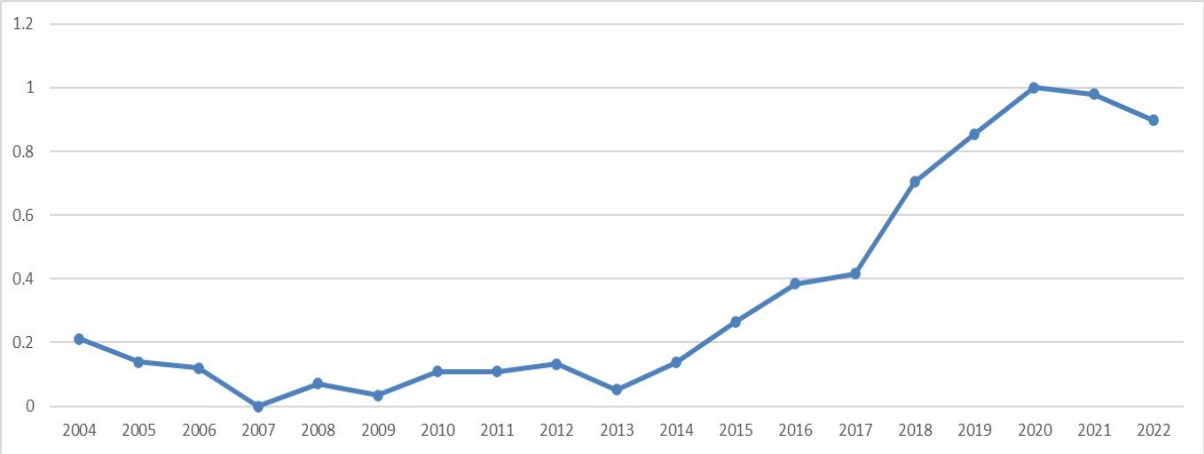
Table 8. Rotated component matrix of equality sub-index

Indicators	PC1	PC2
Female Employment (Services)	**0.916**	0.254
Female/Male Mean Years of Schooling	**0.903**	-0.010
Shares of Seats in Parliament by Women	**0.892**	0.299
Female Employment (% of pop)	**-0.765**	-0.504
Gini Index	**0.527**	-0.102
Female/Male Youth Unemployment	0.091	**0.934**
Female/Male Gross National Income	0.161	**-0.865**
Employment Youth	0.402	**0.853**
Female/Male Labor Force Participation	-0.624	**-0.688**
Initial Eigenvalues		
Total	5.145	1.993
% of variance	57.162	22.149
Cumulative %	57.162	**79.311**

Source: Compiled by the authors using SPSS.
** Extraction Method: PCA.*
** Rotation Method: Varimax with Kaiser Normalization.*
** Rotation converged in three iterations.*

The trend of the constructed equality sub-index in Figure 7 increases during the period 2004-22. This is mainly driven by gender equality and improvement in opportunities for women, where the three main indicators: female employment in the service sector, female to male means year of schooling, and share of female in parliament seats have experienced an increase during this period. For instance, women are currently enjoying the highest level of political participation in the history of Egypt (OECD, 2018), where the share of parliament seats held by women increased from 2.18 percent in 2014 and 2015 to around 22.8 percent in 2021.

Figure 7. Equality sub-index in Egypt (2004-22)



Source: Authors' calculations.

5.4 Governance sub-index

According to the results reported in Table 9, we take the weighted average of the first two PCs. PC1, which has a larger weight, is dominated by political stability, followed by the rule of law, government effectiveness, and regulatory quality. However, PC2, of lower weight, is dominated by voice and accountability followed by control of corruption. Both components explain around 75 percent of the total variation of the data.

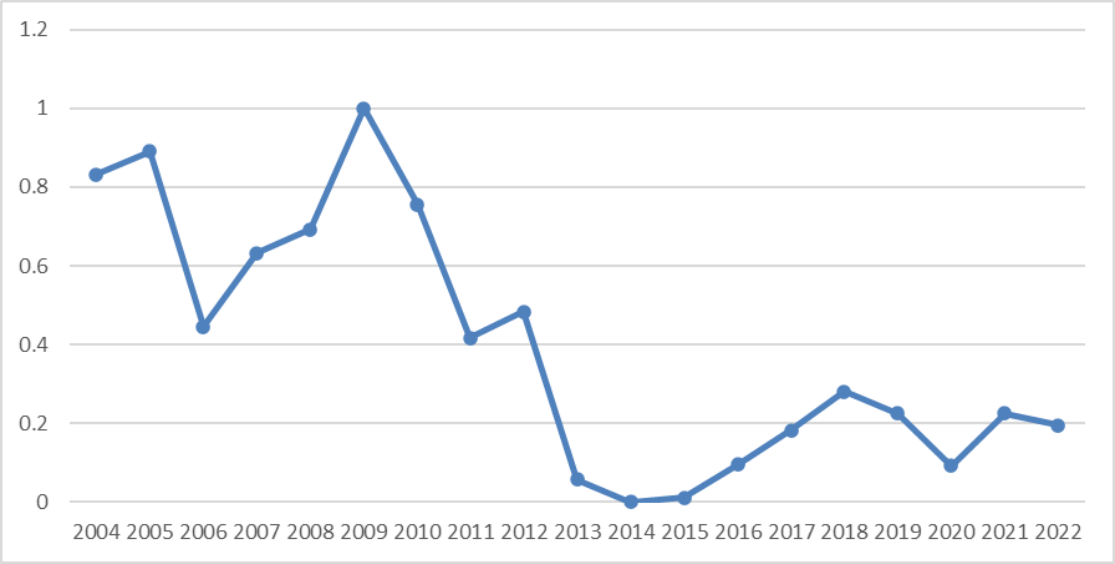
Table 9. Rotated component matrix of governance sub-index

Indicators	PC1	PC2
Political Stability and Absence of Violence	**0.950**	-0.113
Rule of Law	**0.934**	-0.088
Government Effectiveness	**0.863**	-0.226
Regulatory Quality	**0.682**	0.276
Voice and Accountability	0.058	**0.924**
Control of Corruption	-0.132	**0.700**
Initial Eigenvalues		
Total	3.041	1.456
% of variance	50.691	24.271
Cumulative %	50.691	**74.962**

Source: Compiled by the authors using SPSS.
** Extraction Method: PCA.*
** Rotation Method: Varimax with Kaiser Normalization.*
** Rotation converged in three iterations.*

The governance sub-index fluctuated with a declining trend during the period 2004-22. The index dropped significantly since 2009 and reached its minimum in 2014. This is mainly due to the dominant effect of political stability, which also declined since 2009 and continued to decrease during and after the 2011 revolution until it reached its minimum level in 2014, after which it started to increase. In addition, rule of law and government effectiveness, the indicators with the second and third highest factor loadings, showed a declining trend since 2004 and then reached the minimum in 2012, after which both indicators began to increase. Both voice and accountability and control of corruption, which are the dominant indicators of PC2, showed a declining trend during the period of study. However, control of corruption has also started to increase since its minimum level in 2020.

Figure 8. Governance sub-index in Egypt (2004-22)



Source: Authors' calculations.

5.5 The overall IGI

As mentioned in section 3, the second stage of constructing the IGI uses the four-constructed sub-indices as explanatory variables. The results are reported in Table 10, where only PC1 has

an eigenvalue larger than one and hence is extracted. PC1 explains 83.5 percent of the percentage of variance.

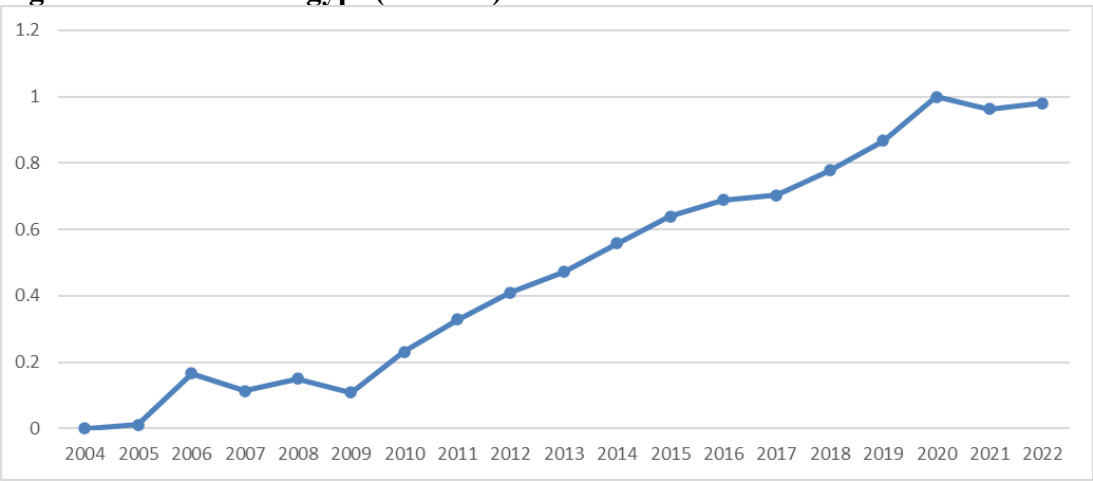
The overall IG in Egypt has shown an increasing trend since 2009. Based on the factor loadings reported in Table 10, both the living condition and economy indices have the largest factor loadings with 0.983 and 0.981, respectively, indicating that the two dimensions are nearly equally weighted and the most important in constructing the IGI in Egypt. The increasing trend of equality, which was dominated by gender equality, also contributed to the rising trend of the IGI but with a lower factor loading (0.870). On the other hand, governance contributed negatively to the IGI with the lowest factor loading (0.809). The results of our IGI reveal that the four dimensions are important in determining the inclusiveness of the economy.

Table 10. Component matrix of IGI

Indicators	**PC1**
Living Conditions	0.983
Economy	0.981
Equality	0.871
Governance	-0.809
Initial Eigenvalues Total	3.341
% of variance	83.535
Cumulative %	**83.535**

Source: Compiled by the authors using SPSS.
** Extraction Method: PCA.*
** One component is extracted.*

Figure 9. The IGI in Egypt (2004-22)



Source: Authors' calculations.

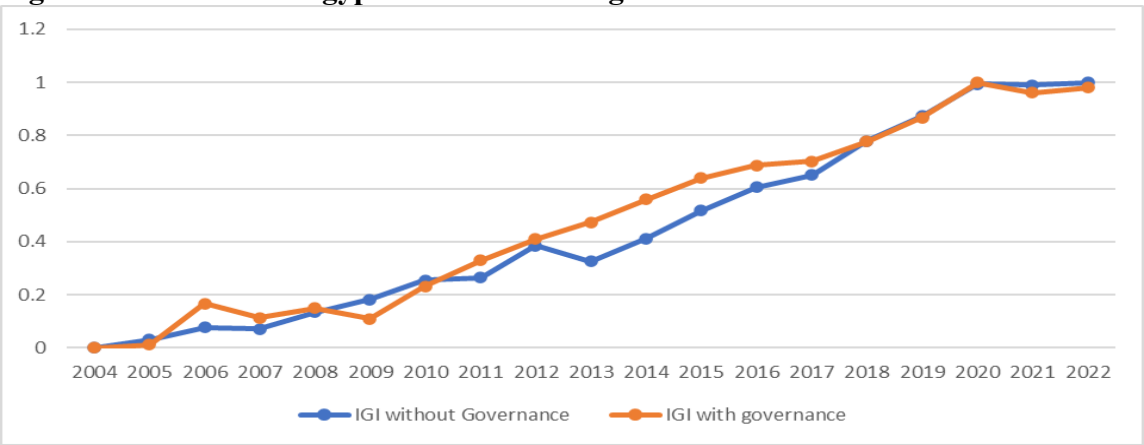
5.6 Alternative Versions of the IGI

In this subsection, we test alternative versions of the IGI to check to which extent adding or removing one of the dimensions affects the constructed index.

First, if the governance sub-index is removed, the factor loadings of the three remaining dimensions are economy (0.985), living conditions (0.975), and equality (0.924), which are nearly equally weighted. Compared to Table 8, the factor loadings of the three dimensions are

very close.[8] Referring to Figure 10, there is a slight difference between the two indices, however, they both show the same trend.

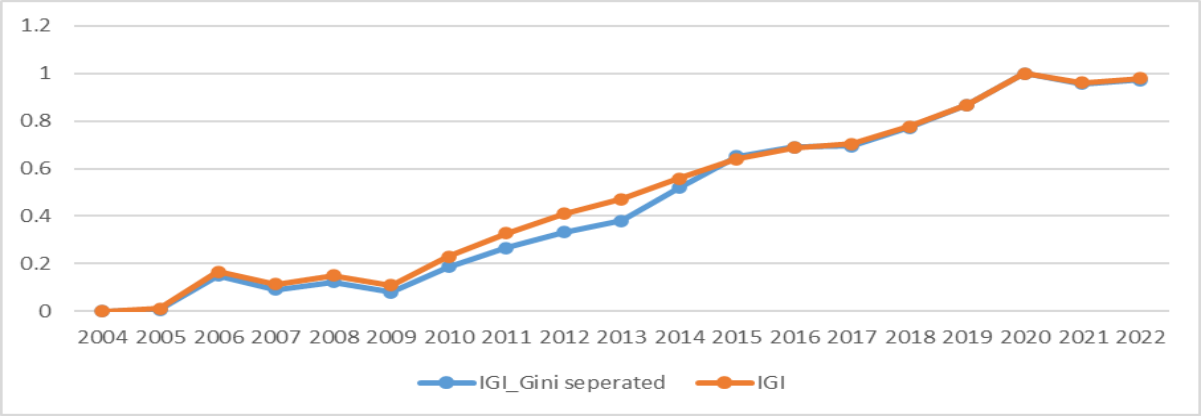
Figure 10. The IGI in Egypt with vs without governance



Source: Authors' calculations.

Second, since income inequality has a lower weight in the equality index constructed in subsection 5.3, we check whether a change might occur if we add the gender equality index and income inequality (Gini index) as separate dimensions in estimating the overall IG index.[9] Under this version of the IGI, we find that the ranking of factor loadings is as follows: 0.976 (living conditions), 0.974 (economy), 0.867 (gender equality), -0.793 (governance), and 0.383 (income inequality measured by Gini index). Hence, all the dimensions have very close factor loadings to those presented in Table 8. Moreover, we find that the Gini index was also allocated very low factor loadings compared to other dimensions. Hence, as supported by Figure 11, this IGI version is nearly the same as the one constructed in section 5.5.

Figure 11. IGI with Gini Index Separated vs IGI



Source: Authors' calculations.

[8] Note that under the IGI without the governance dimension: the KMO test is 0.676 and Bartlett's sphericity test is significant. In addition, only PC1 is extracted and explains 92.431 of the total variances.
[9] Under this version of the IGI: the KMO test is 0.722 and Bartlett's sphericity test is significant. In addition, only PC1 is extracted and explains 68.559 of the total variances.

6. Results of Causality and Discussion

6.1. Causality

The steps of conducting the causality tests start with the unit root tests. The ADF and the Phillips-Perron unit root tests confirm that log FII is stationary only at first difference, however, the logarithmic form of all other variables is either stationary at level or at first difference as shown in Table 11. Therefore, the Toda Yamamoto test is used to identify the direction of causality between the FII and the different pillars of IG as well as the overall IGI. For each model, the related structural break dummy variables are considered.

Examining the causal relationship using the logarithmic form of the variables, the null hypothesis of no causality is rejected at the one percent significance level, i.e., there is a two-way Granger-causality between log (FII) and log (IGI). The results of the Toda-Yamamoto Granger non-causality test are presented in Table 12. Our findings elaborate that bidirectional causality exists between the FII and each of the economic, equality, and governance pillars of the IGI as well as the overall IGI. There is also a bidirectional causality between the FII and IGI without governance.

Table 11. Unit Root Tests

	Augmented Dickey-Fuller Test Statistic		**Phillips-Perron Test Statistic**		**Breakpoint Test Statistic**	**Year of Break**
	Intercept	Trend	Intercept	Trend	Trend and Intercept	
Log (FI)	-1.364	-2.746	-1.257	-2.716	-9.743***	2012
D(Log(FI))	-5.196***	-5.145***	-5.704***	-6.314***		
Log_ECO	-11.848***	-4.992***	-9.068***	-21.011***		
Log_lIVING	-3.442**	-1.305	-8.733***	-21.134***	-27.750***	2008
D(Log_lIVING)		-7.949***				
Log (EQU)	-1.03	-4.219**	-2.149	-5.873***	-9.152***	
D(Log(EQU))	-6.887***	-6.839***	-8.131***	-8.326***		2007
Log_GOV	-1.908	-2.452	-2.035	-2.042		2013
D(Log_GOV)	-3.424**	-3.353*	-3.503**	-3.732**	-5.05***	
Log_IGI	-6.209***	-2.403	-6.451***	-6.408***	-8.945***	2013
D(Log_IGI)		-7.148***				
Log (IG Without Governance)	-1.999	-14.38***	-6.909***	-13.665***	-2.03***	2008

Source: Authors' calculations using EViews.
****, **, *, symbolizes the significance at the one percent, five percent, and 10 percent level, respectively. D( ) refers to first difference.*
Economy, living conditions, equality, and governance (ECO, LIVING, EQU, and GOV).

Table 12. Toda- Yamamoto Granger non-causality test

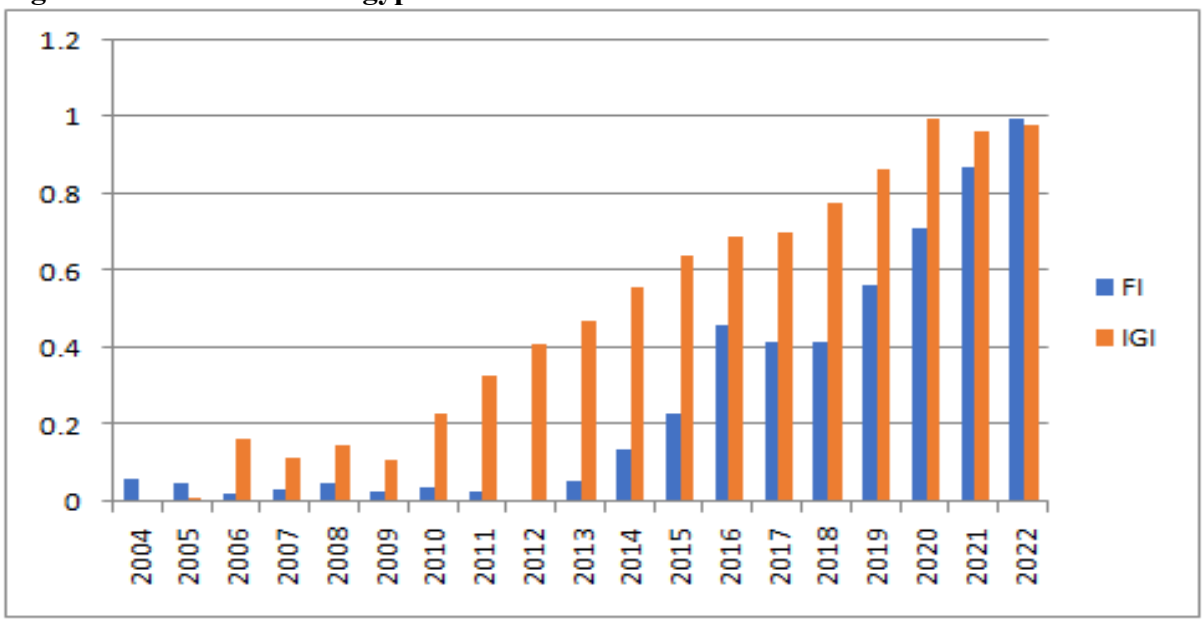
Null Hypothesis	**Chi-squ**	**Direction of Causality**
Log FII does not Granger cause log IGI	13.221***	Bidirectional
Log IGI does not Granger cause log FII	3.243*	Bidirectional
Log FII does not Granger cause log ECON	20.813***	Bidirectional
Log ECON does not Granger cause log FII	63.699***	Bidirectional
Log FII does not Granger cause log LIVING	2.674	None
Log LIVING does not Granger cause log FII	64.709***	Log LIVING causes log FII
Null Hypothesis	**Chi-squ**	**Direction of Causality**
Log FII does not Granger cause log EQU	65.356***	Bidirectional
Log EQU does not Granger cause log FII	17.134***	Bidirectional
Log FII does not Granger cause log GOV	47.337***	Bidirectional
Log GOV does not Granger cause log FII	17.037***	Bidirectional
Log FII does not Granger cause log IGI without governance	33.64***	Bidirectional
Log IGI without governance does not Granger cause log FII	9.958**	Bidirectional

Source: Authors' calculations using EViews.
****, **, * indicates rejection of the null hypothesis at the one percent, five percent, and 10 percent significance level, respectively.*

6.2. Discussion

Figure 12 shows that the FII has significantly increased since 2018, mainly due to improvements in digital access indicators. Reducing dependence on banknotes has been a government priority since 2016 when the CBE introduced regulations for mobile payments and directed banks to boost the share of customers actively using e-wallets. The IGI experienced an upward trend, with its value more than doubling from 2012 to 2022. The living conditions, economy, and equality dimensions contributed positively to IG in Egypt during the period 2004-22. The equality index improvement is mainly related to gender equality as several important laws were amended to guarantee gender equality and women's empowerment in opportunities and rights. However, governance indicators contribute negatively, though with relatively lower weight, to IG, indicating that more improvement in governance indicators is needed to enhance IG in Egypt.

Figure 12. FI and IGI in Egypt



The findings of this paper are consistent with Apergis et al. (2007) and Sethi and Acharya (2018), who find a bidirectional causality between FI and economic growth. Additionally, Aslan et al. (2017) reveal that inequality in financial access is one of the most important factors that significantly impact income inequality. However, we detect a one-way causality running from the living conditions pillar to FI, while the hypothesis that Log (FI) does not Granger cause log (living conditions) cannot be rejected, which means that no causality was evident from FI to living conditions. This is compatible with Kabakova and Plaksenkov (2018), who consider social development a core condition for FI. In contrast, other studies such as Rajan (2009) and Barik et al. (2018) find that FI plays a significant role in enhancing the standard of living.

The bidirectional causality between FI and IG highlights the importance of supply and demand side factors in the success of the financial inclusion strategy (Öncü, 2015; Hassouba, 2023). The supply-side factors are associated with accessibility and affordability, which are reflected in our FII. The demand-side factors include low income, poverty, financial illiteracy, and location in rural/remote areas; those factors can be reflected in the utilized sub-indices of our IGI. The results also highlight the importance of the governance dimension in enhancing IG; this is compatible with the findings of Emara and El Said (2021), revealing that FI positively affects economic growth in countries with good governance and political stability.

7. Conclusion

Several studies investigated the impact of FI on economic growth, while its effect on IG has barely been considered. This study investigates the relationship between FI and IG in Egypt during the period 2004-22. The novelty of this research resides in constructing IGI and FII using the PC method in addition to exploring the direction of causality between them.

Access indicators contribute by a larger weight than usage indicators to the constructed FII. Thus, Egypt suffers from high levels of financial exclusion due to the relatively low levels of access indicators, mainly geographic access. In Egypt, as is the case worldwide, rural regions suffer from a multiplicity of challenges related to low levels of financial literacy. Moreover, those regions have a higher share of poor populations compared to urban ones. However, access to financial services has started to increase in recent years, thanks to advancements in digital access indicators.

The IGI constructed in our paper is composed of four sub-indices: economy, living conditions, equality, and governance. The economy sub-index has an increasing trend over the study period which was associated with the increasing trend of the GDP per capita and labor productivity. Also, living conditions improved because of rising safely managed sanitation and declining mortality rates. However, public expenditure on education has been decreasing, thereby affecting living conditions negatively during this period. The trend of the constructed equality index has been increasing since 2014 because of gender equality and improvement in opportunities for women. The governance index fluctuated with a declining trend during the study period. It has decreased significantly since 2011 because of political instability conditions

associated with the revolution; however, the index started to increase after 2015. The overall IG in Egypt has shown an increasing trend since 2009. The economy and living dimensions have nearly equal weights in the overall index, followed by the equality dimension. The governance dimension showed the lowest factor loading and was correlated negatively to IG, indicating that efforts to improve Egypt's performance in governance indicators would enhance IG.

Since some variables were stationary at level while others at first difference, the Toda-Yamamoto causality test was conducted to examine the direction of causality between FI and IG. Our findings support the bidirectional causal relation between FII and IGI as well as three of the pillars of IG (economic, equality, and governance), while there was unidirectional causality running from living conditions to FI.

The results of this paper explain why the central bank's FI efforts to channel more credit to SMEs, women, and youth did not achieve its intended outcome, as simultaneous efforts are needed to improve the IG levels in Egypt. The unidirectional causality running from living conditions to FI confirms the need for a parallel IG strategy to be able to reap the full benefit of the conducted efforts. Raising the level of public expenditures on health and education is necessary to improve living conditions, consequently fostering IG and FI. Moreover, the bidirectional causality between FI and other dimensions highlights the need for measures to improve gender inequality and access to financial services, establish a well-designed regulatory framework, and invest in innovative technologies that increase the value-added per employee. Further research needs to be developed to compare FI and IG across urban and rural areas.

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