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EXAMINING THE NEXUS OF FINANCIAL INCLUSION, HOUSEHOLD CONSUMPTION, AND ECONOMIC GROWTH: A 3SLS APPROACH

Finansal Kapsayıcılık, Hane Halkı Tüketimi ve Ekonomik Büyüme Arasındaki Bağlantının İncelenmesi: 3SLS Yaklaşımı

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Keywords:
Financial Inclusion Index, Digital Banking Index, Economic Growth, Digital Financial Inclusion, 3SLS, Household Consumption Capital Expenditure.

JEL Codes:
C36, G21, G28, G51, O16

Abstract

The relationship between finance and economy is a long-standing debate in the development literature. While some researchers argue that finance simply follows economic development, others argue that finance is a critical determinant of economic growth. Research findings on this issue vary across countries, periods, data sets, and research methodologies. On the other hand, the relationship between economic growth and financial inclusion is a relatively new area of study in the academic literature. The primary goal of financial inclusion is to ensure that everyone can access and use financial products at an affordable cost. In this context, access to and use of financial products is seen in the context of financial citizenship. This paper examines the impact of digital banking and financial inclusion on economic growth and household consumption in Turkey. For this purpose, financial inclusion and digital banking indices have been constructed. Furthermore, the relationship of these indices with the GDP index and household consumption index is examined using the three-stage least square (3SLS) method with two separate equations. The results show that digital banking and financial inclusion have a positive impact on economic growth and household consumption in Turkey.

Anahtar Kelimeler:
Finansal Kapsayıcılık Endeksi, Dijital Bankacılık Endeksi, Ekonomik Büyüme, Dijital Finansal Kapsayıcılık, 3SLS, Hane Halkı Tüketimi, Sabit Sermaye Harcaması.

JEL Kodları:
C36, G21, G28, G51, O16

Öz

Finans ve ekonomi ilişkisi kalkınma literatüründe uzun zamandan beri tartışma konusu olmuştur. Kimi araştırmacılar finansın basitçe ekonomik gelişmeyi takip ettiğini ifade ederken, kimileri finansın ekonomik büyümenin en önemli belirleyicilerinden birisi olduğunu ifade etmişlerdir. Yapılan araştırmaların sonuçları, ülkeden ülkeye, araştırma dönemine, kullanılan verilerin içeriğine ve araştırma yönteme göre farklılık göstermektedir. Öte yandan, ekonomik büyüme ve finansal kapsayıcılık ilişkisi literatürde çok uzak geçmişe sahip olmayan bir inceleme alanıdır. Finansal kapsayıcılık konusunun önceliği, yetişkin her bireyin finansal kuruluşlara ve finansal ürünlere erişebilmesi ve bunları uygun bir maliyetle kullanabilmesidir. Bu çerçevede, finansal ürünlere erişim finansal vatandaşlık kavramı çerçevesinde ele alınmaktadır. Bu çalışma, dijital bankacılık ve finansal kapsayıcılığın ekonomik büyüme ve hane halkı tüketimi üzerindeki etkisini Türkiye örneği açısından incelenmiştir. Bu amaçla öncelikle dijital bankacılık ve finansal kapsayıcılık endeksleri oluşturulmuş ve bu endeksler ile GSYİH Endeksi ve Yerleşik Hane Halkı Tüketim Endeksi arasındaki ilişki üç aşamalı en küçük kareler (3SLS) yöntemi ve iki farklı denklem seti ile analiz edilmiştir. Sonuçlar, dijital bankacılığın ve finansal kapsayıcılığın, ekonomik büyüme ve hane halkı tüketimi üzerinde pozitif etkisi olduğunu ortaya koymaktadır.

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1. Introduction

The relationship between finance and the economy is a long-standing debate in the development literature. Some researchers argue that finance is the handmaiden of the economy and merely follows economic development, while others argue that finance is a crucial determinant of economic growth. Studies examining the link between finance and the economy vary by country, period, data content, and methodology. Consequently, there is no consensus on the relationship between finance and economic growth within this framework. On the other hand, the relationship between economic growth and financial inclusion is a relatively new area of study in the economic development literature. The fundamental concept of financial inclusion is to ensure that every adult has convenient access to financial products at a reasonable cost.

This research paper examines the relationship between digital banking, financial inclusion, economic growth, and household consumption in Turkey. To this aim, the study develops digital banking and financial inclusion indices. Then, it analyzes their relations with GDP and household consumption indices using the method proposed in the literature. Principal component analysis (PCA) is used to determine the optimal vector combination of different indicators of the indices. The index series is constructed from quarterly data from December 2006 to December 2020. The study uses two sets of equations and three-stage least squares (3SLS) to analyze the impact of the indices on economic growth and household consumption.

A digital banking index has been developed for Turkey to evaluate the extent of digital banking. As 87% of the financial sector comprises banking assets, this index is based on the internet and mobile banking data of the banking system. Additionally, the digital banking index is used to create the financial inclusion index. Through analyzing the relationship between these indices and the Gross Domestic Product (GDP) and Household Consumption Index using the 3SLS method, it has been found that both indices positively impact economic growth and household consumption in Turkey. Additionally, the analysis shows that increasing the total assets of the banking sector in Turkey will increase capital expenditure.

The paper's contribution to the literature is integrating the digital aspect of financial inclusion into the financial inclusion index. Additionally, this study aims to measure the impacts of financial inclusion and digital financial inclusion on economic growth and household consumption. The study will implement the 3SLS methodology to measure this impact.

2. Relationship between Financial Development and Economic Growth

The financial sector is a set of institutions, instruments, and markets that enable transactions on credit. The development of the financial sector is fundamentally linked to overcoming "costs" in the financial system. Reducing information, transaction, and contract enforcement costs has led to the emergence of financial contracts, markets, and intermediaries. Financial systems contribute to reducing poverty and inequality by (i) increasing access to finance for vulnerable groups of society, (ii) reducing vulnerability to financial shocks, (iii) enabling the management of risk, (iv) expanding investment opportunities, and (v) increasing productivity (World Bank, 2016).

A literature review on economic development shows disagreement about the interaction between the financial sector and economic growth. In this context, there are two views of the relationship between finance and the economy. According to the first view, finance is essentially the handmaiden to industry, and financial development follows economic growth (King and Levine, 1993). According to Robinson (1952), who is considered the foremost economist of this view, economic initiatives drive finance, and finance follows. In this framework, finance does not cause growth but merely responds to the demands of the real sector (Levine, 2005). According to Robinson, economic growth increases the demand for financial contracts, and finance responds. This view is the growth-led finance hypothesis (Choong and Chan 2011). This skeptical view that finance does not affect the economy is derived from the mechanics of the neoclassical growth model. Most economists who held this view believed that financial systems had only minor effects on physical capital and investment rates. As a result of Solow's (1956, 1957) analyses, finance had only minor effects on economic growth following changes in investment (King and Levine, 1993).

On the other hand, the opposite view argues that the financial system is a crucial determinant of economic growth. This view is defined as the finance-led growth hypothesis. Walter Bagehot (1873) was the first to state this view. (Huang, 2010: 1). According to Bagehot, lendable funds are allocated to investors, then these funds support the adoption of new technologies, increasing the production process of the economy, and gradually this process spreads to the whole economy (Sethy, 2016).

Schumpeter (1912), Gurley and Shaw (1955), Hicks (1969), and Goldsmith (1969) argue that advanced financial systems and markets accelerate economic development, while underdeveloped financial systems impede economic growth. Hicks (1969) also states that the industrial revolution had to wait for the financial revolution due to the large capital requirements and long-term commitments to projects (Mutlugün, 2014).

However, studies of the finance-growth relationship using different statistical methods for different countries and over different periods have produced different results, and no consensus conclusions have been reached on the direction, magnitude, and mutual influence of the finance-growth relationship.

On the other hand, it is acknowledged that finance can contribute to reducing poverty and inequality for poor and vulnerable groups, by reducing their vulnerability to financial shocks, managing risks, and increasing their productivity and investment (World Bank, 2016).

2.1. Access to Finance, Financial Inclusion, and Financial Development

The concept of financial inclusion was first introduced in 1993 by geographers concerned with the closure of bank branches, resulting in limited physical access to banking services (European Commission 2008: 9). Leyshon and Thrift (1995) and Thrift and Leyshon (1999) discussed access to finance in the context of its opposite, financial exclusion. The authors defined *access* to finance as the processes that prevent poor and disadvantaged social groups from accessing the financial system. It was argued that financial exclusion exacerbates geographical disparities in income and economic development and indicates inequitable development. This situation should be addressed within “financial citizenship” and resolved regarding poor individuals and disadvantaged groups (Leyshon and Thrift 1995; Thrift and Leyshon, 1999).

On the other hand, *financial inclusion* is defined as making financial services available to disadvantaged, vulnerable, and low-income groups -including households, small and mediumsized enterprises, and traders - fairly and transparently and at an affordable cost. Financial inclusion is a necessary structure for equal opportunities for all segments of society in a country, for endogenous growth, economic and social development, and job opportunities (Devi, 2015).

Financial inclusion and access to finance are different issues. Financial inclusion is focused on use, but a lack of use does not always mean a lack of access. Many people need access to financial services because these services have prohibitive costs or have barriers to their use, such as regulations requiring onerous paperwork, travel distance, legal hurdles, or other market failures. Others may choose to refrain from using financial services despite having access at affordable prices. Nevertheless, there is growing recognition that most of the barriers that limit access to services can be overcome by better policies (Demirgüç-Kunt et al., 2015).

Well-functioning financial systems serve a vital purpose, offering people with various needs savings, payment, credit, and risk management products. Inclusive financial systems can benefit poor and disadvantaged groups by granting them access to appropriate financial services. For example, access to formal savings and credit mechanisms can help people invest in productive activities like education or entrepreneurship. Without such access, individuals rely on their limited informal savings, and small businesses depend on their limited earnings to seize opportunities for growth, leading to persistent income inequality and slower economic growth (Demirgüç-Kunt and Klapper, 2013).

Policy-setting organizations have defined financial access and inclusion in different ways, and these definitions outline the significant elements of these concepts. The World Bank defines financial access as "having an account with a formal financial institution." Having and using an account with a formal financial institution facilitates access to financial services by reducing account operating costs and providing proximity to financial intermediaries (Allen et al., 2016). Another World Bank study defined financial inclusion as the absence of price and non-price barriers in using financial services (Demirgüç-Kunt et al., 2015).

The International Monetary Fund (IMF) defines access to finance as excluding individuals and businesses from access to financial services beyond the efficiency criteria. There are voluntary and involuntary forms of financial exclusion, and the main objective should be to include all segments of society, excluding those who cannot access financial services due to income criteria and those who are considered risky (Amidzic et al., 2014).

The OECD defines financial inclusion as the access of society to a wide range of regulated financial products at an affordable cost, in a timely and adequate manner, as well as the extension of the use of these products and services by all segments of society by making the existing structure available to all segments of society (Atkinson and Messy, 2013: 11). The European Union (EU) defines access to finance through financial exclusion. In the EU's definition, financial exclusion refers to the difficulties experienced by individuals in accessing and using suitable financial products and services that meet their own needs and enable them to participate in social activities within the community (Kempson et al., 2007).

Kempson and Whyley (1999: 1-21) identify five forms of financial exclusion.

1- **Access Exclusion:** It defines the population excluded from the financial system due to distance or risk management processes in the financial system.
2- **Condition Exclusion:** Refers to the exclusion that arises because the conditions are unsuitable for certain individuals.

3- Price Exclusion: It occurs because the prices of financial products are unaffordable for some people.

4- Market Exclusion: This occurs due to the marketing and selling of financial products only to a targeted audience.

5- Self-exclusion: Occurs when a person excludes himself/herself from the financial market within the framework of psychological barriers due to fear of rejection or other factors.

The World Bank presents four forms of financial exclusion in Figure 1 (World Bank, 2013: 16).

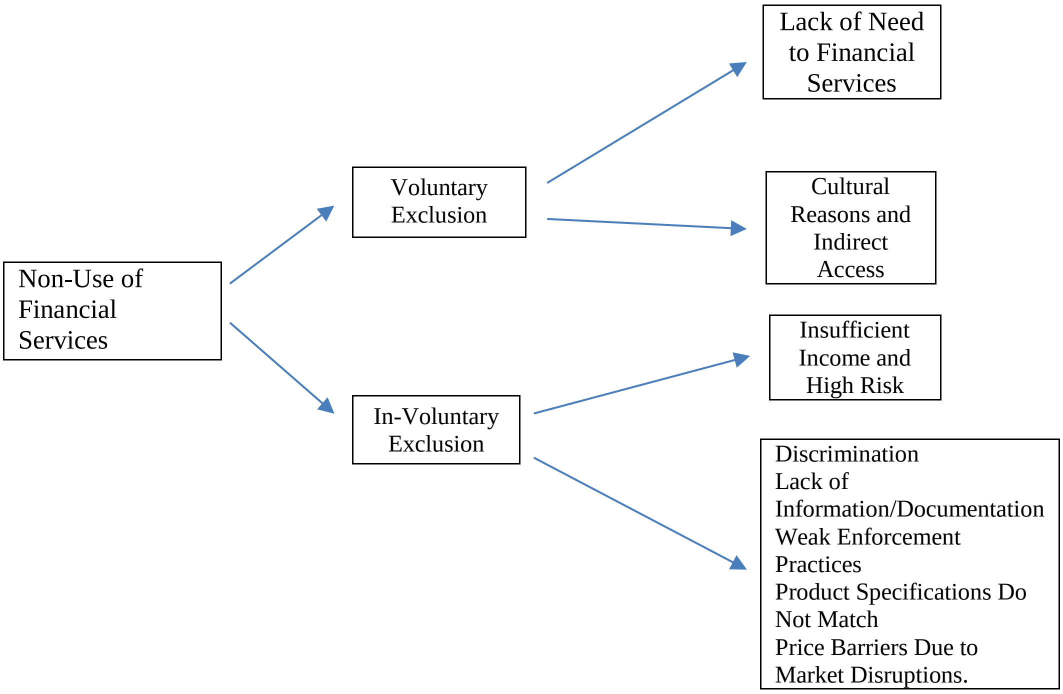


Figure 1. Types of Financial Exclusion
Source: Adopted from World Bank, 2013: 16.

Voluntary exclusion refers to individuals or firms who choose not to use financial services for various reasons, such as lack of a suitable project, cultural or religious reasons, or simply not needing the service. This type of exclusion arises due to a lack of demand. In contrast, specific segments of the population are involuntarily excluded from the financial system because they have insufficient income or are deemed too risky for the credit market. This type of exclusion cannot be attributed to market failures. As a result, there is limited scope for addressing this kind of exclusion. However, financial literacy or supporting financial institutions that offer tailored products for cultural and religious demands can be used to improve financial inclusion. Another category of non-voluntary exclusion refers to individuals and organizations that are excluded due to regulatory barriers and market failures. This category requires policy action when there are individuals for whom the marginal returns of financial services exceed marginal costs. However, these individuals are excluded due to market failures, such as high account fees, distance of access, and lack of suitable products (Amidzic at al., 2014).

Inclusive financial systems are desirable for various reasons. First of all, it allows for an efficient allocation of resources. Secondly, access to appropriate financial services enables individuals and firms to conduct daily financial transactions. Thirdly, an inclusive financial system reduces informal credit channels. In this framework, an inclusive financial system increases investment by efficiently allocating productive resources, accelerates economic growth, and contributes to capital formation (Sarma, 2012). On the other hand, access to financial markets enables individuals to continue their education, enhance their professional skills, and obtain the capital they need for their ventures beyond what their families can provide. It provides expanded opportunities that might not otherwise have been available (Demirgüç-Kunt and Levine, 2008).

The view of policymakers that an inclusive financial system is an essential component of economic and social development is supported by a growing body of evidence in the literature. There is a growing recognition that financial inclusion is a critical factor in reducing poverty and in the internalization of economic growth that is inclusive of all sectors. Research shows that when individuals participate in the financial system, they can more easily start new businesses, improve existing ones, invest in education, manage risks, and absorb financial shocks (Demirgüç-Kunt et al., 2015).

On the other hand, according to Honohan (2008), while there is some econometric evidence that greater household access to finance reduces inequality, there is little evidence that financial access and inclusion are directly related to poverty reduction. The studies show that financial access and inclusion are essential, but their statistical significance disappears when income and distribution variables are included. In other words, financial development reduces poverty through the depth dimension beyond the access and inclusion dimension. Interestingly, the interaction between the more traditional measure of financial development, depth (bank credit), and financial access is high, making financial access important. However, when the depth dimension is below average income per capita, the marginal effect of access is positive.

2.2. Indicators of Financial Inclusion

According to Amidzic et al. (2014), an inclusive financial system has three primary dimensions. These are physical access, using a bank account to save, and using the bank account frequently. The physical access dimension refers to the ease of physical access to the service point. The World Bank's 2021 Global Findex report shows that distance is a barrier for 31 percent of unbanked adults (Demirgüç-Kunt et al., 2021). The lack of physical availability of financial service points mainly affects people living in rural areas. On the other hand, in some countries, people living in the cities may also be in this situation. More financial inclusion is associated with a better environment that enables people to access financial services, such as lower banking costs and more proximity to branches. The dimensions of use and quality of financial services are related to meeting consumers' needs. Financial inclusion is the optimal combination of these three dimensions (Amidzic et al., 2014).

Camara and Tuesta (2014) define financial inclusion in three dimensions: usage, access, and barriers to access. According to the authors, a high level of use of financial services or a high number of financial access points indicates an inclusive financial system. However, factors such as GDP per capita, financial literacy, legal infrastructure, cultural habits, and public attitudes toward financial services can affect the use of formal financial institutions. In this context, physical infrastructure like ATMs and bank branches partially indicates the accessibility of the financial system. On the other hand, it may be incorrect to assume that a higher rate indicates a more inclusive financial system, given the need for more information on the concentration and location of these infrastructures. In this sense, focusing only on access and usage leads to a limited financial inclusion measurement. Researchers argue that an inclusive financial system should minimize involuntary exclusion while maximizing usage and access. Therefore, the three dimensions of financial inclusion -usage, access, and barriers to access- should be assessed together to measure financial inclusion.

Kainth (2013) considered the financial inclusion index to have three dimensions and defined these dimensions as the penetration of banking services in the market, availability, and usage. AFI (2013b: 38), identified the dimensions of financial inclusion as access, usage, and quality, defining access as formal and regulated financial services and proposing physical proximity and affordability as criteria for this dimension. The usage dimension states that regular and frequent use of financial services and the duration of use should be essential. The quality dimension is defined as developing products that meet customers' needs and income levels.

Sarma (2012) divides financial inclusion indicators into macro and micro indicators. While macro indicators are bank accounts per 1,000 people, bank branches per 100,000 people, domestic credit/GDP ratio, domestic deposit GDP ratio, and micro indicators are the percentage of people with an account in a formal financial institution, the percentage of people using an account in a formal financial institution for savings, the percentage of people using an account in a formal institution for borrowing, and the percentage of people borrowing from a non-formal institution.

As indicators of access and use in the banking sector, Beck et al. (2007) propose the following criteria in their study:

-Branch distribution by region (geographical): Number of branches per 1,000 km^2,

-Branch distribution per capita (demographic): Number of branches per 100,000 inhabitants,

-Distribution of ATMs by region (geographical): Number of ATMs per 1,000 km^2,

-ATM distribution per capita (demographic): ATMs per 100,000 inhabitants,

-Number of loans per capita (prevalence): Number of loans per 1,000 inhabitants,

-Loan-to-income ratio (affordability): Ratio of the average loan amount to per capita income,

-Number of deposits per capita (prevalence): Number of deposits per 1,000 population,

The financial inclusion indicators identified by the Alliance for Financial Inclusion (AFI, 2013a) are presented in Table 1.

Table 1. AFI Financial Inclusion Indicators

Dimension	Definition	Main Indicator	Proxy Indicator	Description
Access	Ability to Use Financial Services: Minimum Barrier to Open an Account	Number of Access Points per 10,000 Adults in the Country		Regulated Access Points where cash-in and cash-out transactions can be performed.
	Physical Proximity, Affordability	Access Unit with At Least One Processing Point (%)		Available if the Distance to the Access Point is Consistently Detected
		Total Population Living in Access Unit with At Least One Access Point		
Usage	Actual Use of Financial Products/Services (Frequency of Use)	The proportion of Adults with at least one Deposit Account (%)	Number of Deposit Accounts per 10,000Adult	Country Defined Adult Age
		The proportion of Adults with at least one Credit Account (%)	Number of Credit Accounts per 10,000 Adult	

Source: AFI (2013a).

The G-20 Global Partnership for Financial Inclusion (GPFI) has identified a different set of financial inclusion indicators, as presented in Table 2.

Table 2. G-20 Financial Inclusion Indicators

Dimension	Category	Indicator	Global Data Source
Usage	Officially Banked Adults	% of Adults with an Account at a Formal Financial Institution	Global Findex
		Deposit Accounts Per 1,000 Adults	IMF Fas
Usage	Adults with credit at regulated institutions	% of Adults with Loans at Regulated Institutions	Global Findex
		Outstanding loans per 1,000 adults	IMF Fas
Usage	Formally banked enterprises	SMEs with an account at a formal financial institution (%)	WB Entrepreneur Survey
		Number of SME deposit accounts at a formal financial institution	IMF Fas
Usage	Enterprises with outstanding loans or line of credit at regulated institutions	SMEs with an outstanding loan or line of credit (%)	WB Entrepreneur Survey
		Percentage of adults with at least one loan outstanding from a bank or other formal financial institution	IMF Fas
Access	Physical Points of Service	Number of branches per 100,000 adults	IMF Fas

Source: CGAP (2012).

In line with the literature, financial inclusion has been analyzed along three dimensions: 1) Penetration, 2) Access, 3) Usage. The indicators of these dimensions are defined as follows as suggested by (Ekmen, 2023a);

Indicators of 1) Penetration consists of i) number of active users of mobile and ii) internet banking in the banking system; 2) Access dimension consists of i) number of bank branches, ii) number of ATM's, iii) number of bank employees; 3) Usage dimension consists of i) total loan amount (Million TL), ii) deposits per capita (Million TL), iii) digital Banking Index (Author's calculation).

3. Construction of the Indices

In order to evaluate the extent of financial inclusion in an economy, it is essential to have a scale that combines all aspects of financial inclusion into one number. This scale should measure financial inclusion consistently across different economies and countries. Additionally, this scale should be appropriate for tracking policy changes over time (Camara and Tuesta, 2014).

In this context, indicators related to different dimensions of financial inclusion should be combined in a multidimensional index framework to create an index with a value between 0 and 1. An index value of 0 indicates complete financial exclusion in the economy, while an index value of 1 indicates complete inclusion in the economy (Sethy, 2016). The financial inclusion index will be calculated based on data obtained from the banking sector, which accounts for 87% of the Turkish financial sector's assets.

3.1. Data

The data used to construct the indices is classified into two categories. The first set of data comprises banking data that is used to construct the financial inclusion index. These data points include the number of active bank customers, total loans, total deposits, total number of branches, ATMs, bank employees, and total assets.

The second set of data includes indicators of the use of digital banking, which consists of transactions carried out via banks' mobile and Internet banking platforms. These transactions include non-financial transactions, money transfers, bill payments, credit card payments, other financial transactions, and the number of active customers.

The digital banking data is derived from the Internet and mobile banking statistics reports available on The Banks Association of Turkey (TBA) website. The other banking data is obtained from the interactive monthly bulletin of the Banking Regulation and Supervision Agency (BRSA). Lastly, macro aggregates data macro aggregates data is sourced from the Turkish Statistical Institute (TURKSTAT) website. Note that the figures are quarterly and cover periods from December 2006 to December 2020.

3.2. Methodology

At this research stage, each indicator's quarterly values, representing different index dimensions, should be combined to create an index. Each indicator has been considered a separate index dimension in constructing the index. Therefore, there will be no aggregation of indicators within the same dimension.

To construct the index, it is first necessary to determine the optimal vector between the time series of different dimensions. PCA was applied to these indicators to find the optimal vector combination. The coefficients obtained from the PCA analysis were multiplied by the indicator values in the time series to generate the optimal vector combination.

After this calculation, the quarterly values of the optimal vector were converted into index series ranging from 0 to 1 in order with the following formulation.

$$di = \frac{A(i) - Min(i)}{Max(i) - Min(i)} \tag{1}$$

where d(i) is the value of the index for each period; A(i) is the current value of the variable; Max (i) is the maximum value of the variable for all the periods analyzed; and Min (i) is the minimum value of the variable for all the periods analyzed.

3.3. Construction of the Financial Inclusion Index

The following indicators are used to construct the Financial Inclusion Index, representing the dimensions of penetration, access, and usage;

- Number of the active customers[1]
- Outstanding Deposit Amount (TL million)
- Outstanding Loan (TL million)
- Number of the Bank Employees
- Number of the Bank Branches
- Number of ATMs
- Digital Banking Index (DBI) (Author's calculations)

The optimal vector coefficients found by the PCA analysis in the framework described above are shown in Table 3.

Table 3. Result of PCA Analysis for the Financial Inclusion Index

Variables	**Coefficient of PCA**
Outstanding Loan (OL) (β_1)	0.412942
Number of ATM's (ATM) (β_2)	0.403639
Total Deposits (TD)(β_3)	0.404315
Number of Active Customers (AC) (β_4)	0.395549
Digital Banking Index (DBI) (β_5)	0.366804
Number of Bank Branches (BB) (β_6)	0.332323
Number of Bank Employees (BE) (β_7)	0.318811

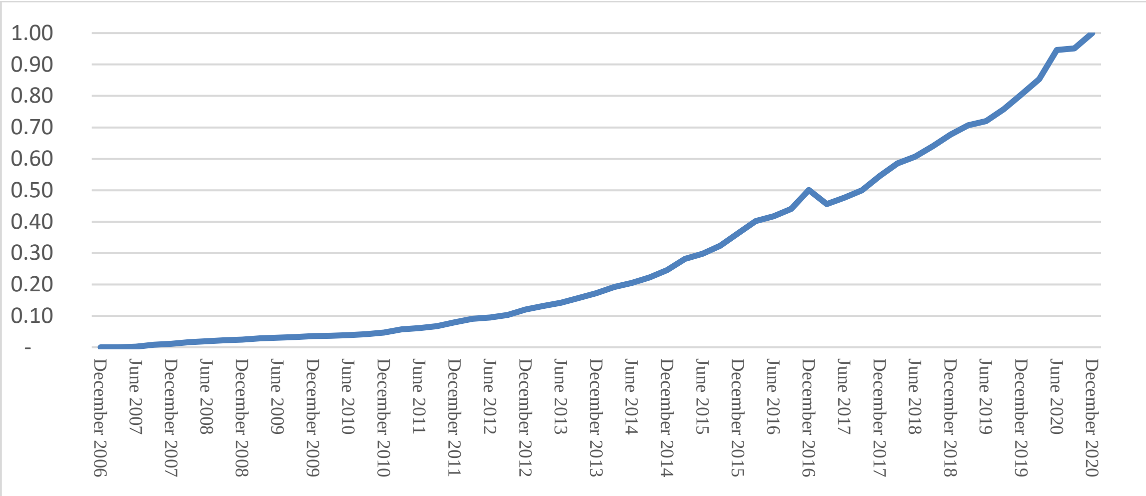
Source: BRSA Monthly Bulletin, Digital Internet and Mobile Banking Reports, TBA

As can be seen from the results of the PCA analysis, although the ratios are pretty close, outstanding loans, number of ATMs, and total deposits contribute most to the financial inclusion index. On the other hand, the contribution of the number of bank branches and the

[1] Number of customers actively using Internet and mobile banking platforms in the banking system

number of bank employees to the financial inclusion index remains low. As a result, the optimum vector values have been calculated as follows;

$$FIIT = \beta 1 OLT + \beta 2\, ATMT + \beta 3\, TDT + \beta 4\, ACT + \beta 5\, DBI + \beta 6\, SBT + \beta 7\, BE \qquad (2)$$



Graph 1. Financial Inclusion Index

The graph of the constructed Financial Inclusion Index is shown in Graph 1. As shown in Graph 1, financial inclusion has increased rapidly over the period under review. However, while financial inclusion was relatively low in 2006, it has increased in Turkey since the 2010s. The increase after 2015 is remarkable.

3.4. Construction of the Digital Banking Index

The Digital Banking Index has been calculated using the abovementioned index calculation method. Data for the Digital Banking Index is based on digital, mobile, and internet banking statistics from the Banking Association of Turkey (BAT).

In constructing the Digital Banking Index, the indicators used in the calculation to represent each dimension are listed below:

- Number of active customers[2] (representative of the penetration dimension)

- Total number of payments[3] (representative of the usage dimension)

- Number of Money transfers[4] (representative of the usage dimension)

[2] Number of customers actively using Internet and mobile banking platforms in the banking system
[3] Includes; bill payments, tax payments, SSK and Bag-Kur (Social Security) payments, loan payments, MTV (Vehicle Tax), traffic fines and other payments.
[4] Includes Electronic Fund Transfers, wire, and currency remittance (Includes payments such as foreign currency transfers via SWIFT and similar payment systems, MoneyGram, Western Union, etc.).

- Number of other financial transactions[5] (representative of the access dimension)

- Number of credit card transactions[6] (representative of the usage dimension)

- Number of non-financial transactions [7](representative of the access dimension)

PCA analysis was performed on the time series data, and the resulting coefficients for the optimal vector combination are presented in Table 4.

Table 4. PCA Coefficient for Digital Banking Index

Variables	**Coefficient of PCA**
Money transfers (β_1)	0.4138
Credit Card Transactions (β_2)	0.4133
Payments (β_3)	0.4122
Non-financial transactions (β_4)	0.4103
Active Customers (β_5)	0.4021
Other financial transactions (β_6)	0.3972

Source: BAT Mobile and Internet Banking Transactions Reports

Although the obtained coefficients are close, the most significant contribution to the optimal vector size, hence to digital financial inclusion, among these indicators are the Number of Money Transfers, Number of Credit Card Transactions, and Number of Payments.

In this context, the optimum vector values are calculated as follows;

$$DBIT \;=\; \beta 1\, MTT \;+\; \beta 2\, CCTT \;+ \beta 3 PYMT \;+ \beta 4\, NFTT \;+ \beta 5\, AC + \beta 6\, OFTT \qquad (3)$$

where; MT is Money Transfers; CCT is Credit Card Transactions; PYM is Payments; NFT is Non-Financial Transactions; ACT is Active Customers; and OFT is Other financial transactions.

After calculating the optimal vector, the periodic values were converted into an index series ranging from 0 to 1, based on the following formula to obtain the Digital Banking Index.

$$di = \frac{A(i) - Min(i)}{Max(i) - Min(i)} \qquad (4)$$

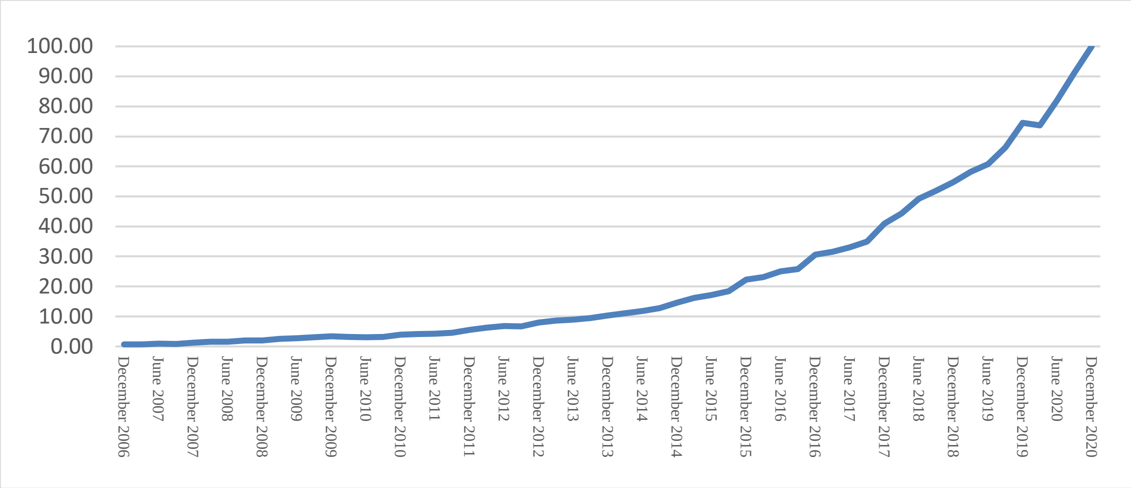
where d(i) is the value of the index for each period; A(i) is the current value of the variable; Max (i) is the maximum value of the variable for all the periods; and Min (i) is the minimum value of the variable for all the periods.

The resulting Digital Banking Index graph is shown in Graph 2. It clearly shows a significant uptick in the index since 2010, indicating a remarkable increase in digital banking transactions. The Digital Banking Index is an essential tool for tracking the progress of all mobile and internet banking transactions within a single, comprehensive index.

[5] Includes data on transfers from investment account to time/demand deposit account or from time/demand deposit account to investment account, time deposit partial withdrawal/deposit, virtual POS transactions, virtual card transactions, bulk transfer transactions, credit utilization transactions against securities, VIOP (Turkish Derivatives Exchange) collateral deposit/withdrawal, etc.

[6] Includes the sum of the cash advance, cash advance in instalments, debt paid on own card, debt paid on someone else's card.

[7] Includes data on loan applications, credit card applications, and the number of regular payment instructions (instructions given for future/regular EFT, money orders, dues, private school fees, apartment building fees, rent and cooperative payments, public offering instalment payments, etc.).



Graph 2. Digital Banking Index

4. Relationship between the Indices and the Macro Economic Variables

After constructing the indices, the 3SLS method and E-Views 10 econometric software are used to analyze the impact of digital banking on economic growth and household consumption.

4.1. Macro Data

The macro-aggregate data are indexed figures published by TURKSTAT, covering the 57 quarterly periods between December 2006 and December 2020. The figures for the total number of ATMs and total banking assets are obtained from BRSA monthly reports and are indexed series based on the period starting in March 2007.

4.2. The Model

The 3SLS, based on the seemingly unrelated regression (SUR) model, provides a solution as a system of equations. This method is called "unrelated" because the dependent variables in the equations appear to be unrelated. However, the error terms are correlated. By removing the relationship between the error terms in the model's equations, the computation of the SUR equation system becomes a separate ordinary least squares (OLS) system. This way, the SUR method allows for the joint estimation of the relationship between different banking variables and growth and macroeconomic aggregates (Koç, 2018; Koç et.al., 2021).

A simultaneous equations model can be illustrated as

$$\begin{bmatrix} y1 \\ y2 \\ . \\ . \\ . \\ . \\ . \\ . \\ . \\ yn \end{bmatrix} . xi = \begin{bmatrix} x1 & 0 & .. & 0 \\ 0 & x2 & & 0 \\ . & & & \\ . & & & . \\ . & . & & . \\ . & . & & . \\ . & . & & . \\ . & & & . \\ 0 & & & xn \end{bmatrix} . \beta i = \begin{bmatrix} \beta 1 \\ \beta 2 \\ . \\ . \\ . \\ . \\ . \\ . \\ . \\ \beta n \end{bmatrix} . \phi 1 = \begin{bmatrix} \phi 1 \\ \phi 2 \\ . \\ . \\ . \\ . \\ . \\ . \\ . \\ n \end{bmatrix}$$

where $y_i = \beta_i x_i + \phi_i$

Here, the mean of ϕ is zero, and the variance-covariance matrix of the equation represents the correlation between the error terms of the different structural equations (Koç vd., 2021). However, as with other multi-equation models, the variables in the 3SLS model should be stationary. Otherwise, "spurious regression" may occur. On the other hand, multi-equation methods such as 3SLS or 2SLS can be applied to non-stationary but long-run co-integrated time series (Hsiao: 1997a, b; Hillebrand and Koray, 2008; Koç et al., 2021).

On the other hand, in the case of bidirectional causality between variables, there may be a correlation between the error terms and the explanatory variables, in which case the endogeneity problem may arise. In this context, the correct estimation method is 3SLS (Görmüş and Hotunluoğlu, 2011).

The 3SLS equation system is considered the most efficient method of controlling the endogeneity of regressors and cross-equation error correlation. It is stated that 3SLS is an efficient estimator if the equations in the equation sets are properly defined. This equation system is more effective in capturing the interrelationships between equations and the causal and feedback effects between the main variables in the system. (Soukiazis et al., 2013; Soukiazis et al., 2018).

There are three stages in the estimation procedure of the equation with the SUR method;

1. Each equation is estimated separately using the OLS method.
2. The variances of the estimators and the covariance of the model are calculated by using residuals obtained by the OLS estimates.
3. Using the estimates obtained in the second stage, all equations are estimated jointly in a generalized OLS framework (Hill, 2011).

The paper first examines whether the time series is stationary in this context. Then, it looks for a co-integration relationship between the different series using the Johansen co-integration test. Finally, it estimates the relationship between the digital banking index and macroeconomic aggregates using the 3SLS model.

4.3. Stationarity Analysis

In studies that involve time series data, it is essential to check whether the series are stationary. If non-stationary series are used, the regression analysis results can be unreliable and lead to incorrect conclusions. On the other hand, a stationary series does not have a unit root, and its mean, variance, and covariance do not change over time (Enders, 2004: 171; Gujarati, 2004, p.713; Çonkar and Vergili, 2017).

In a dynamic model, the value of each variable in the current period depends on its value in the previous period or periods. Therefore, all kinds of information from the previous period and the shocks exposed to it can affect the variable. By examining how the variable's value in the previous period affects the current period, one can discover the long-run characteristics of a series. Therefore, to understand the data generation process of the series, it is sufficient to regress the value of the series in each period on its previous value (Torun, 2015; Bekçioğlu et al., 2018).

"If our definition of this series is Yt, then we obtain the equation of

$$Y_t = \beta Y_{t-1} + U_t \qquad U_t \cong N\ (0, \sigma^2) \tag{5}$$

If the value of β equals 1, then the variable Yt is influenced by its value one period earlier, i.e., by the shocks it experienced. But if β is less than 1, the effect of previous period shocks will gradually diminish and disappear entirely after a short time. This hypothesis can be summarized as follows;

H_0: β=1 The series has a unit root (the series is not stationary).

H_a: β<1 The series has no unit root (the series is stationary).

The hypothesis mentioned above has been developed using the Dickey-Fuller test, which is widely used due to its ease of use. However, if the residuals obtained by estimating the equations exhibit autocorrelation, the results of the unit root test may not be reliable. To address this issue, Dickey and Fuller introduced the Augmented Dickey-Fuller (ADF) test, which involves a model as shown below:

$$\Delta Y_t = \mu + \partial_t + (\beta - 1)Y_{t-1} \sum_{1}^{k} \lambda\, i\ \Delta Y_{t-i} + Ut \tag{6}$$

Hypothesis for the ADF test is as follows;

H_0: β=1 the series has a unit root (the series is not stationary).

H_a: β<1 the series has no unit root (the series is stationary). (Yurdakul, 2000).

Results show non-stationary indicators at level values but become stationary at first-order differences.

ADF tests assume the error terms have constant variance, and their means are time-varying. From this perspective, ensuring that the error terms are not correlated and have constant variance is necessary. Phillips and Perron (1988) extended the ADF test and proposed a non-parametric unit root test method. This method considers serial correlation and variance changes in the error terms.

In the PP methodology,

$$\begin{gathered} R_t = x_0 + x_1 * R_{t-1} + et \\ R_t = x_0 + x_1 * R_{t-1} + x_2 = \left(t - \frac{T}{2}\right) + et \end{gathered} \tag{7}$$

T is the number of observations, and et denotes the error term. (Yavuzaslan et al., 2017).

Table 5. ADF and PP Test Results

Variables	Symbol	ADF	PP
GDP	ϒ	0.0000	0.0000
Economic Confidence Index (ECI)	Θ	0.0000	0.0000
Resident Household Consumption Index	*C*	0.0010	0.0000
Financial Inclusion Index	Α	0.0004	0.0003
Digital Banking Index (DBI)	Β	0.0000	0.0000
Number of ATMs	Φ	0.0145	0.0159
Unemployment Index (UI)	Θ	0.0012	0.0002
Capital Expenditure (CE)	∅	0.0000	0.0001
Total Assets (TA)	Π	0.0000	0.0000

Note: *Results for differences of the first order.

Table 5 shows the ADF and PP test results for the time series used in the paper. In order to use the 3SLS method, it is necessary for the data being analyzed to be stationary in the same order as mentioned above. The null hypothesis is rejected after calculating the first-order differences in the data. So, if the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests indicate that the series is stationary, then the 3SLS method can be applied to these series. After conducting the stationarity analysis, the Johansen co-integration test was performed on the series.

4.4. Co-Integration Test

Soren Johansen and Katarina Juselius created the Johansen co-integration test in 1988 and 1990 to test the idea of co-integration. This method tests for the structure of multiple co-integrations in cases where more than one variable is analyzed. This method gets estimates of the co-integration parameters and counts the number of co-integration vectors using Johansen's maximum likelihood estimation approach. The Johansen approach is preferred when the equations have more than two variables (Koç et al., 2021).

The co-integration test is a method used to determine if the residuals of a regression model are stationary or have unit roots. If the residuals are stationary, there is a long-run relationship between the variables and no spurious regression. On the other hand, to apply this method, all variables in the model should be non-stationary before the application and stationary in the first differences (İçellioğlu and Özturk, 2018).

The stationarity of the series has been tested in our previous analyses and the results are presented in Table 6.

The hypotheses that have been tested using the Johansen method are as follows:

H0: $\rho<0.05$ There is co-integration in the series.

Ha: $\rho>0.05$ There is no co-integration in the series.

Table 6. Johansen Co-integration Test Results

	Eigenvalue	Trace Statistic	Critical Value	(Prob.)
Trace	0.844521	3.913.903	2.084.374	0.0000
Max.Eigen Value	0.807095	2.927.445	1.695.991	0.0000

As can be seen from the results in Table 6, the probability value is less than the critical value of 0.05. This indicates that there is a long-run co-integration relationship between the series. Given that the time series are co-integrated, we can apply the 3SLS model.

4.5. Model Implementation

This study uses two sets of 3SLS equations to examine the relationship between the financial inclusion and digital banking indices with GDP and household consumption indices. The first set of equations is defined as follows;

$$\gamma t = \delta 0 + \delta 1 * \alpha t + \delta 2 * \theta t \tag{8}$$

$$Ct = \nu 0 + \nu 1 * \beta t + \nu 2 * \varphi t \tag{9}$$

$$\emptyset = \phi 0 + \phi 1 * \vartheta t + \phi 2 * \pi t \tag{10}$$

where γ is Gross Domestic Product (GDP); α is Index of Financial Inclusion (FI); C is Household Consumption; β is Digital Banking Index (DBI); θ is Economic Confidence Index (ECI); φ is Total Number of ATMs (ATM); ϑ is Unemployment Index (UI); $\emptyset$ is Capital Expenditure (CE); and π is Banking Sector Total Asset (TA).

The equation (8) examines the connection between GDP, financial inclusion, and the economic confidence index. The equation (9) analyzes the relationship between household consumption (a subcomponent of GDP), digital banking, and the total number of ATMs. Finally, the equation (10) links capital expenditure (another subcomponent of GDP), the total assets of the banking sector, and unemployment.

4.5.1 Results of the First Model

Table 7 displays the findings from the analysis of the 3SLS model. The model mainly investigates the relationship between financial inclusion and GDP, household consumption with digital banking, and the number of ATMs. The final equation assesses the effect of total banking assets on capital expenditure.

Table 7. Results for the First Equation Set

Dependent Variables	Independent Variables	Coefficient	t Statistic	Probability
GDP (ϒ)	Constant Coefficient (δ)	59.75954	3.281360	0.0013
	Financial Inclusion Index (α)	0.001864	15.77005	0.0000
	Economic Confidence Index (θ)	0.535105	3.044859	0.0027
Household Consumption (C)	Constant Coefficient (ν)	61.52737	18.89568	0.0000
	Digital Banking Index (β)	0.001979	9.12116	0.0000
	Total ATM (φ)	0.351401	19.89568	0.0000
Capital Expenditure (Ø)	Constant Coefficient (ϕ)	145.4443	14.89199	0.0000
	Unemployment Index (ϑ)	-0.387640	-4.469557	0.0000
	Total Assets (π)	0.041105	3.764480	0.0002

The results can be interpreted as follows;

(i) A statistically significant positive relationship exists between the GDP and financial inclusion indexes. When the financial inclusion index increases one unit, there is an associated increase in the GDP by 0.18%. This result shows that increased financial inclusion increases economic growth in Turkey.

(ii) As expected, a statistically significant and positive relationship exists between the economic confidence index and GDP. One unit increase in economic confidence raises the GDP by 53.5%.

(iii) A statistically significant and positive relationship exists between digital banking and household consumption, with a one-unit increase in digital banking resulting in a 0.19% increase in household consumption.

(iv) A statistically significant positive relationship exists between the total ATMs and the resident household consumption index. One unit increase in the total number of ATMs results in a 35.1% increase in resident household consumption. This result indicates that improving access to finance increases household consumption as well.

(v) As expected, there is a negative relationship between the capital expenditure and unemployment indexes. An increase of one unit in the unemployment rate index reduces capital expenditure by 38.7%.

(vi) A statistically significant positive relationship exists between the capital expenditure index and total banking assets. An increase of one unit in total assets of the banking system increases capital expenditure by 4.1%.

4.5.2. Results of the Second Model

The second equation set examines the relationship between the digital banking index and GDP and between the financial inclusion index and household consumption. The third equation set is identical to the first set. The formulation for the second set of equations is as follows:

$$\gamma t = \delta 0 + \delta 1 * \beta t + \delta 2 * \theta t \quad (11)$$

$$Ct = \nu 0 + \nu 1 * \alpha t + \nu 2 * \varphi t \quad (12)$$

$$\emptyset = \mu 0 + \mu 1 * \vartheta t + \mu 2 * \pi t \quad (13)$$

Table 8 presents the results of the second set of equations estimated using the 3SLS model. The model primarily examines the relationship between digital banking, GDP, financial inclusion, and the number of ATMs and household consumption. The final equation estimates the influence of total banking assets on capital expenditures.

Table 8. Results for the Second Equation Set

Dependent Variables	Independent Variables	Coefficient	t Statistic	Probability
	Constant Coefficient (δ)	74.36284	2.939863	0.0038
GDP (Υ)	Digital Banking Index (β)	0.005515	10.23952	0.0000
	Economic Confidence Index (θ)	0.473055	1.926875	0,0558
	Constant Coefficient (ν)	64.47886	18.09437	0.0000
Household Consumption (C)	Financial Inclusion Index (α)	0.000664	8.427266	0.0000
	Total ATM (φ)	0.321763	15.21265	0.0000
	Constant Coefficient (ϕ)	145.7953	14.85766	0.0000
Capital Expenditure (Ø)	Unemployment Index (ϑ)	-0.386253	-4.433836	0.0000
	Total Assets (π)	0.039807	3.639317	0.0004

The results can be interpreted as follows:

(i) A statistically significant and positive relationship exists between the GDP and digital banking. An increase of one unit in the digital banking index leads to a 0.5% increase in the GDP index. This result indicates that with an increase in the use of digital banking channels, economic growth will also increase. As digital banking channels are the access points to finance, strengthening access to finance will also raise economic growth.

(ii) As expected, a statistically significant and positive relationship exists between the economic confidence index and GDP. An increase of one unit in economic confidence increases the GDP by 47.3%.

(iii) There is a statistically significant and positive relationship between the financial inclusion and household consumption indexes. An increase of one unit in financial inclusion results in a 0.06% increase in household consumption.

(iv) A statistically significant positive relationship exists between the total ATMs and the household consumption index. An increase of one unit in the total number of ATMs raised the resident household consumption by 32.1%. This significant result highlights the importance of financial access points where households can carry out financial transactions.

(v) A statistically significant and positive relationship exists between total assets in the banking sector, which can be considered a proxy indicator of the financial inclusion and capital expenditure index. Increasing one unit in the banking sector's total assets raises capital expenditures by 3.9% in Turkey.

(vi) As expected, there is a negative relationship between unemployment and capital expenditure. An increase of one unit in the Unemployment Index reduces the Capital Expenditure Index by 38.6%.

5. Conclusion and Recommendations

Although the relationship between finance and economic growth has long been discussed in the economics literature, the link between financial inclusion and economic growth is a relatively new area of research.

The main objective of financial inclusion is to ensure that every adult has access to and can afford financial products and services. In this context, the access of all adults to financial products and services is addressed within the framework of “financial citizenship”. Access to and cost-effective use of financial services increases the quality of life of individuals, enables them to carry out daily financial transactions, and enables them to manage risks and make savings.

Within the context of this article, the relationship between financial inclusion and economic growth is analyzed in the case of Turkey. In order to reveal this connection, firstly, digital banking and financial inclusion indices are constructed, and their relationship with the GDP index and resident household consumption index is analyzed.

To construct the indices, various indicators were identified from the literature. The optimal vector size was determined using PCA analysis and combined accordingly. The resulting optimal vector time series was then converted into a quarterly index series.

After creating the digital banking index, it has been added to the financial inclusion index. With the integration of the Digital Banking Index as a vector dimension in constructing the Financial Inclusion Index, financial inclusion has become inclusive of the digital financial inclusion dimension. This differentiation distinguishes the constructed financial inclusion index from previous financial inclusion indices in the literature.After constructing the indices, the relationship between the indices and the macroeconomic variables is analyzed using the 3SLS model and two sets of equations.

The analysis conducted on the Financial Inclusion Index indicates that in Turkey, financial inclusion positively impacts economic growth and household consumption. Moreover, the analysis carried out on the Digital Banking Index reveals that the rise in digital banking transactions is associated with an increase in GDP and household consumption.

Meanwhile, the results of both models show that increasing the number of ATMs also raises the household consumption index. These results imply that the development of access to finance increases household consumption and, thus, household welfare. In the meantime, analyzing the relationship between total banking sector assets, which can be seen as a proxy for financial inclusion, it is found that an increase in total banking sector assets increases capital expenditure.

This study has significantly contributed to the literature by creating a digital banking index and integrating the digital financial inclusion dimension into the financial inclusion index via the digital banking index. The other contribution to the literature is measuring the impact of both financial inclusion and digital financial inclusion on economic growth and household consumption using the 3SLS model. Moreover, the study also reveals that the increase in financial sector assets leads to a direct increase in capital expenditure

The findings on financial inclusion are consistent with the results obtained for financial inclusion are in line with Sahay et al. (2015), who states that financial inclusion increases economic growth up to a point, Loukoianova et al. (2018), who find that a 1% increase in the financial inclusion index leads to a cumulative increase of 0.2% per capita for low-income developing countries, Sharma (2016), who find positive and significant association between the various dimensions of financial inclusion, Ali et al. (2019), who found that financial inclusion has a positive effect on economic growth both in the short run and the long run, Thatsarani et al. (2021), who found that financial inclusion has a positive effect on economic growth in the short run, Bozkurt and Karakuş (2020), who found a causal relationship from GDP per capita to the Financial Inclusion Index score, both in the long run and in the short run, Kaya (2017), who found co-integration relationship between financial access and economic growth in Turkey, and Avcı (2022), who found that financial inclusion increases economic growth in the short and long run.

The findings on digital financial inclusion are also in line with Thathsarani (2021), which states that digital banking contributes to the achievement of sustainable development goals in South Asian countries, Li et al. (2022), which states that digital financial inclusion has a positive effect on farmers' income growth in China, Adeoye, and Alenogehna (2019), which states that internet usage has a positive effect on financial access and economic growth, Khera et al. (2021), which states that digital financial inclusion is positively correlated with GDP per capita growth for 52 developing countries, Andrianaivo and Kpodar (2011), which reveals that the use of mobile phones and other ICTs contributes to growth in African countries, and Shen et al. (2018), which states that there is a significant and positive relationship between the use of digital financial products and financial inclusion.

In this context, our policy recommendations for enhancing financial inclusion and supporting economic growth and household consumption are as follows;

(i) Increasing the scope and penetration of banking applications through online platforms such as Internet banking, call center banking, mobile banking applications, and fin-techs,

(ii) Increasing the number of physical points of access to finance, such as ATMs,

(iii) Establishing agent banking infrastructures that allow basic banking transactions such as money transfers and deposits to be carried out in shopping centers such as pharmacies, grocery stores, and markets, as has been observed in many countries,

(iv)Improving access to a range of financial products and services for especially small and family businesses.

"With the advancements in information and communication technology, mobile phones are now considered as virtual bank branches" (Ekmen, 2023b). Therefore, it is crucial to support fin-tech initiatives and expand digital banking platforms to enhance financial inclusion, particularly for households residing in rural areas where distance is a hindrance in utilizing financial services.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest
There are no potential conflicts of interest in this study.

References

Adeoye, B.W. and Alenoghena, R.O. (2019). Internet usage, financial inclusion and economic growth in Nigeria. *Ovidius University Annals, Economic Sciences Series*, 19(2), 2-12. Retrieved from https://doaj.org/

AFI. (2013a). *Measuring financial inclusion core set of financial inclusion indicators* [Dataset]. Retrieved from https://www.afi-global.org/wp-content/uploads/publications/afi%20fidwg%20report.pdf

AFI. (2013b). Defining and measuring financial inclusion. In T. Triki and I. Faye (Eds.), *Financial inclusion in Africa* (pp. 31-42). Tunisia: African Development Bank.

Ali, N., Fatima, K. and Ahmed, J. (2019). Impact of financial inclusion on economic growth in Pakistan. *Journal of Managerial Sciences*, 13(3), 166-174. Retrieved from https://journals.qurtuba.edu.pk/

Allen, F., Demirguc-Kunt, A., Klapper, L. and Peria, M.S.M. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation*, 27, 1-30. https://doi.org/10.1016/j.jfi.2015.12.003

Amidzic, G., Massara, M.A. and Mialou, A. (2014). *Assessing countries' financial inclusion standing - A new composite index* (International Monetary Fund Working Paper No. 14/36). Retrieved from https://www.elibrary.imf.org/view/journals/001/001-overview.xml

Andrianaivo, M. and Kpodar, K. (2011). *ICT, financial inclusion, and growth: Evidence from African countries.* Retrieved from https://www.afdb.org/pt/documents/document/aec-2010-ict-financial-inclusion-and-growth-evidence-from-african-countries-21771

Atkinson, A. and Messy, F.A. (2013). *Promoting financial inclusion through financial education: OECD/INFE evidence, policies and practice* (OECD Working Papers on Finance, Insurance and Private Pensions No. 34). https://doi.org/10.1787/5k3xz6m88smp-en

Avcı, B.S. (2022). Financial inclusion and economic growth: An analysis for Turkey. *KMU Journal of Social and Economic Research*, 24(42), 241-254. Retrieved from https://dergipark.org.tr/tr/pub/kmusekad

Bagehot, W. (1873). *Lombard Street: A description of the money market.* London: HS King.

Beck, T., Demirguc-Kunt, A. and Peria, M.S.M. (2007). Reaching out: Access to and use of banking services across countries. *Journal of Financial Economics*, 85(1), 234-266. https://doi.org/10.1016/j.jfineco.2006.07.002

Bekçioğlu, S., Kaderli, Y. and Varlık, B. (2018). BİST 100 endeksinin spektral analiz yöntemiyle incelenmesi. *Muhasebe ve Finansman Dergisi*, 78, 87-110. https://doi.org/10.25095/mufad.412530

Bozkurt, I. and Karakus, R. (2020). Finansal içerme-ekonomik gelişmişlik ilişkisi: Dünya geneli için ampirik bir inceleme. *Third Sector Social Economic Review*, 55(3), 1504-1523. https://doi.org/10.15659/3.sektor-sosyal-ekonomi.20.06.1357

Cámara, N. and Tuesta, D. (2014). *Measuring financial inclusion: A muldimensional index* (BBVA Working Paper No. 14/26). Retrieved from https://www.bbvaresearch.com/wp-content/uploads/2014/09/WP14-26_Financial-Inclusion.pdf

CGAP. (2012). *Better data can mean better decisions for financial inclusion.* Retrieved from https://www.cgap.org/blog/better-data-can-mean-better-decisions-for-financial-inclusion

Choong, C.K., and Chan, S.G. (2011). Financial development and economic growth: A review. *African Journal of Business Management*, 5(6), 2017-2027. https://doi.org/10.5897/AJBM10.772

Çonkar, M.K., and Vergili, G. (2017). Kredi temerrüt swapları ile döviz kurları arasındaki ilişki: Türkiye için ampirik bir analiz. *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 10(4), 59-66. https://doi.org/10.38057/bifd.1213894

Demirgüç-Kunt, A. and Klapper, L. (2013). Measuring financial inclusion: Explaining variation in use of financial services across and within countries. *Brookings Papers on Economic Activity*, 2013(1), 279-340. https://doi.org/10.1353/eca.2013.0002

Demirgüç-Kunt, A., Klapper, L., Singer, D. and Ansar, S. (2021). *The global findex database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. Washington, DC: World Bank.

Demirgüç-Kunt, A., Klapper, L.F., Singer, D. and Van Oudheusden, P. (2015). *The global findex database 2014: Measuring financial inclusion around the world* (World Bank Policy Research Working Paper No. 7255). Retrieved from https://documents1.worldbank.org/curated/en/187761468179367706/pdf/%20WPS7255.pdf

Demirgüç-Kunt, A. and Levine, R. (2008). *Finance and economic opportunity*. Washington, DC: World Bank.

Devi, S.K.D. (2015). Promoting financial inclusion in rural areas through co-operative banks: With special reference to DCCB, Paderu agency. *International Journal of Research in Commerce, Economics and Management*, 5(1), 85-88. Retrieved from https://ijrcms.com/

Ekmen, İ. (2023a). *Finansal kapsama ve internet bankacılığının ekonomik büyüme ve hane halkı tüketimine etkisi Türkiye örneği* (Yayımlanmamış doktora tezi). Ankara Üniversitesi, Ankara.

Ekmen, İ. (2023b). Internet banking index as a measure of digital financial inclusion in banking. *Journal of Human Sciences*, 20(1), 1-15. Retrieved from https://www.j-humansciences.com

Enders, W. (2004). *Applied econometric time series* (2. ed.). New York: University of Alabama.

European Comission. (2008). *Financial services provision and the prevention of financial exclusion report.* Retrieved from https://www.bristol.ac.uk

Goldsmith, R.W. (1969). Financial structure and development. New Haven, CT: Yale University Press.

Görmüş, Ş. and Hotunluoğlu, H. (2011). Demokrasinin Türkiye'nin ihracat ve ithalatı üzerine etkisi. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 24(4), 99-111. Retrieved from https://dergipark.org.tr/tr/pub/trendbusecon

Gujarati, D.N. (2004). *Applied econometrics.* Singapore: Mc. Graw-Hill International Editions.

Gurley, J.G. and Shaw, E.S. (1955). Financial aspects of economic development. *The American Economic Review,* 45(4), 515-538. Retrieved from https://www.jstor.org

Hicks, J.R. (1969). A theory of economic history. Oxford: Clarendon Press.

Hill, R. (2011). *Hedonic price indexes for housing* (OECD Working Paper No. 01). Retrieved from https://www.oecd-ilibrary.org/economics/hedonic-price-indexes-for-housing_5kghzxpt6g6f-en

Hillebrand, E. and Koray, F. (2008). Interest rate volatility and home mortgage loans. *Applied Economics*, 40(18), 2381-2385. https://doi.org/10.1080/00036840600949538/

Honohan, P. (2008). Cross-country variation in household access to financial services. *Journal of Banking & Finance*, 32(11), 2493-2500. https://doi.org/10.1016/j.jbankfin.2008.05.004

Hsiao, C. (1997a). Cointegration and dynamic simultaneous equations model. *Econometrica: Journal of the Econometric Society*, 65(3), 647-670. https://doi.org/10.2307/2171757/

Hsiao, C. (1997b). Statistical properties of the two-stage least squares estimator under cointegration. *The Review of Economic Studies*, 64(3), 385-398. https://doi.org/10.2307/2971719/

Huang, Y. (2010). *Determinants of financial development*. Berlin: Springer Nature.

İçellioğlu, C.Ş. and Öztürk, M.B.E. (2018). Bitcoin ile seçili döviz kurları arasındaki ilişkinin araştırılması: 2013-2017 dönemi için Johansen testi ve Granger nedensellik testi. *Maliye ve Finans Yazıları*, 109, 51-70. https://doi.org/10.33203/mfy.343217

Kainth, G.S. (2013). Developing an index of financial inclusion. *Anvesha*, 6(2), 1-10. Retrieved from https://www.proquest.com/

Kaya, B. (2017). Türkiye'de finansal erişim ve ekonomik büyüme ilişkisi: Eşbütünleşme ve nedensellik analizi. *Düşünce Dünyasında Türkiz*, 44, 139-167. Retrieved from https://www.tasav.org/

Kempson, E., Crame, M. and Finney, A. (2007). *Financial services provision and prevention of financial exclusion* (Eurobarometer Report, August 2007). Retrieved from https://www.bristol.ac.uk/media-library/sites/geography/migrated/documents/pfrc0808.pdf

Kempson, H.E. and Whyley, C.M. (1999). Understanding and combating financial exclusion. *Insurance Trends*, *21*, 18-22. Retrieved from https://www.bristol.ac.uk/

Khera, P., Ogawa, M.S. and Sahay, M.R. (2021). *Is digital financial inclusion unlocking growth?* (IMF Working Papers No. 167). Retrieved from https://0-www-elibrary-imf-org.library.svsu.edu/view/journals/001/2021/167/001.2021.issue-167-en.xml

King, R.G. and Levine, R. (1993). Finance, entrepreneurship and growth. *Journal of Monetary Economics*, 32(3), 513-542. https://doi.org/10.1016/0304-3932(93)90028-E

Koç, İ. (2018). Interest rate risk in interest-free banks: An empirical research on Turkish participation banks. *Turkish Journal of Islamic Economics*, 5(1), 89-108. Retrieved from https://dergipark.org.tr/en/pub/beuntujise

Koç, İ., Bumin, M. and Demir, Y. (2021). Piyasa volatilitesinin konut kredi hacmine etkisi: Türk bankacılık sektörüne ilişkin bir uygulama. *Finansal Araştırmalar ve Çalışmalar Dergisi*, 13(25), 608-622. https://doi.org/10.14784/marufacd.976616

Levine, R. (2005). Finance and growth: Theory and evidence. In P. Aghion and S.N. Durlauf (Eds.), *Handbook of Economic Growth* (Volume 1, Part A) (pp. 865-934). https://doi.org/10.1016/S1574-0684(05)01012-9/

Leyshon, A., and Thrift, N. (1995). Geographies of financial exclusion: Financial abandonment in Britain and the United States. *Transactions of the Institute of British Geographers*, 20(3), 312-341. https://doi.org/10.2307/622654

Li, Y., Wang, M., Liao, G. and Wang, J. (2022). Spatial spillover effect and threshold effect of digital financial inclusion on farmers' income growth - Based on provincial data of China. *Sustainability*, 14(3), 1838. https://doi.org/10.3390/su14031838

Loukoianova, E., Yang, Y., Guo, S., Hunter, L., Jahan, S., Jamaludin, F., … Wu, Y. (2018). *Financial Inclusion in Asia-Pacific. International Monetary Fund* (IMF Departmental Paper No. 18/17). Retrieved from https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2018/09/18/Financial-Inclusion-in-Asia-Pacific-46115

Mutlugün, B. (2014). The relationship between financial development and economic growth for Turkey. *Journal of Economic Policy Researches*, 1(2), 85-115. Retrieved from https://dergipark.org.tr/en/pub/iuipad

Robinson, J. (1952). The model of an expanding economy. *The Economic Journal*, 62(245), 42-53. https://doi.org/10.2307/2227172

Sahay, M.R., Cihak, M., N'Diaye, M.P., Barajas, M.A., Mitra, M.S., Kyobe, … Yousefi, M.R. (2015). *Financial inclusion: Can it meet multiple macroeconomic goals?* (IMF Staff Discussion Note No. 15/17). Retrieved from https://www.elibrary.imf.org/view/journals/006/006-overview.xml

Sarma, M. (2012). *Index of financial inclusion–A measure of financial sector inclusiveness* (Berlin Working Papers on Money, Finance, Trade and Development No. 07/2012). Retrieved from https://finance-and-trade.htw-berlin.de/fileadmin/HTW/Forschung/Money_Finance_Trade_Development/working_paper_series/wp_07_2012_Sarma_Index-of-Financial-Inclusion.pdf

Sethy, S.K. (2016). Developing a financial inclusion index and inclusive growth in India. *Theoretical and Applied Economics*, 23(2), 607. Retrieved from https://www.ectap.ro/

Sharma, D. (2016). Nexus between financial inclusion and economic growth: Evidence from the emerging Indian economy. *Journal of Financial Economic Policy*, 8(1), 13-36. https://doi.org/10.1108/JFEP-01-2015-0004

Shen, Y., Hu, W. and Hueng, C.J. (2018). *The effects of financial literacy, digital financial product usage and internet usage on financial inclusion in China.* Paper presented at the 2018 3rd International Conference on Circuits and Systems. Lisbon, Portugal. Retrieved from https://www.matec-conferences.org/articles/matecconf/abs/2018/87/matecconf_cas2018_05012/matecconf_cas2018_05012.html

Solow, R.M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics,* 70(1), 65-94. https://doi.org/10.2307/1884513

Solow, R.M. (1957). Technical change and the aggregate production function. *The Review of Economics and Statistics,* 39(3), 312-320. https://doi.org/10.2307/1926047

Soukiazis, E., Antunes, M. and Kostakis, I. (2018). The Greek economy under the twin-deficit pressure: A demand orientated growth approach. *International Review of Applied Economics*, 32(2), 215-236. https://doi.org/10.1080/02692171.2017.1338678

Soukiazis, E., Cerqueira, P.A. and Antunes, M. (2013). Growth rates constrained by internal and external imbalances and the role of relative prices: Empirical evidence from Portugal. *Journal of Post Keynesian Economics*, 36(2), 275-298. https://doi.org/10.2753/PKE0160-3477360205

Thathsarani, U.S., Wei, J. and Samaraweera, G. (2021). Financial inclusion's role in economic growth and human capital in South Asia: An econometric approach. *Sustainability*, 13(8), 4303. https://doi.org/10.3390/su13084303

Thrift, N. and Leyshon, A. (1999). *Moral geographies of money. Nation-states and money: The Past, present and future of national currencies.* London: Routledge.

Torun, N. (2015). *Birim kök testlerinin performanslarının karşılaştırılması* (Yayınlanmamış doktora tezi). İstanbul Üniversitesi Sosyal Bilimler Enstitüsü, İstanbul.

World Bank. (2013). *Global financial development report 2014: Financial inclusion* (WB 82556). Retrieved from https://documents1.worldbank.org/curated/en/225251468330270218/pdf/Global-financial-development-report-2014-financial-inclusion.pdf

World Bank. (2016). *Global financial development report 2016* (World Bank). Retrieved from https://www.worldbank.org/en/publication/gfdr/gfdr-2016

Yavuzaslan, K., Damar, Ö., Sönmez, B., Özdaş, B., Uyar N., Akılotu, E. (2017). Türkiye'de genç işsizliğinin, işsizlik histerisi hipotezi çerçevesinde yapısal kırılmalar testi ile analizi. *Aydın İktisat Fakültesi Dergisi*, 2(2), 21-32. Retrieved from https://dergipark.org.tr/en/pub/aifd/

Yurdakul, F. (2000). Yapısal kırılmaların varlığı durumunda geliştirilen birim-kök testleri. *Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 2(2), 21-34. Retrieved from https://dergipark.org.tr/en/pub/gaziuiibfd/