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DIGITAL FINANCIAL INCLUSION AND ITS DETERMINANTS: EVIDENCE FROM TÜRKİYE*

Dijital Finansal Kapsayıcılık ve Belirleyicileri: Türkiye Örneği

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Keywords: Digital Financial Inclusion, Digital Technologies, Digital Finance, Banking Sector

JEL Codes: O11, O30, O39, E44

Abstract

Facilitating participation in the financial system through digital technologies became important to identify the determinants of Digital Financial Inclusion (DFI). In this context, the study aims to examine the use and accessibility of DFI and measure it specifically for Türkiye. The data is divided into two categories: demographic variables (gender, age, income, and education level) and variables related to DFI (account ownership, ownership of mobile money account, saving, and borrowing) and was compiled from the Global Findex Database 2021. Considering the binary structure of the dependent variable, the probit model was used in the study. Although our model findings indicate that demographic characteristics such as gender, education, and income have a significant effect on account ownership and savings, when marginal effects are taken into account, education is the strongest determinant of DFI. Regarding the income level, the coefficient estimates for the four income quintiles were found statistically significant. However, for lower-income quintiles, particularly the poorest 20 percent and the second 20 percent, the probability of being financially included was found to be significantly lower. When all variables are taken into consideration, women are more financially excluded than men, and there is significant gender inequality, especially in terms of account ownership.

Anahtar Kelimeler: Dijital Finansal Kapsayıcılık, Dijital Teknolojiler, Dijital Finans, Bankacılık Sektörü

JEL Kodları: O11, O30, O39, E44

Öz

Dijital teknolojiler aracılığı ile finansal sisteme katılımın kolaylaşması, Dijital Finansal Kapsayıcılığın (DFK) belirleyicilerinin tespit edilmesi açısından önemli hale gelmiştir. Bu kapsamda çalışmada, DFK'nın kullanımı ve erişebilirliği incelenerek, Türkiye özelinde ölçülmesi amaçlanmıştır. Veriler, demografik değişkenler (cinsiyet, yaş, gelir ve eğitim düzeyi) ve DFK ilgili değişkenler (hesap sahipliği, mobil para hesap sahipliği, tasarruf ve borçlanma) olmak üzere iki kategoriye ayrılmış olup Global Findex Database 2021 veri tabanından derlenmiştir. Bağımlı değişkenin binary yapısı göz önüne alındığında çalışmada probit model kullanılmıştır. Model bulgularımız cinsiyet, eğitim ve gelir gibi demografik özelliklerin, hesap sahipliği ve tasarruf üzerinde önemli bir etkiye sahip olduğunu işaret etse de marjinal etkiler dikkate alındığında DFK'nın en güçlü belirleyicisinin eğitim olduğunu göstermektedir. Gelir düzeyine ilişkin olarak dört gelir dilimine ilişkin katsayı tahminleri istatistiksel olarak anlamlı bulunmuştur. Bununla birlikte, daha düşük gelir dilimleri için, özellikle en yoksul %20'lik kesim ile ikinci %20'lik kesimin finansal açıdan dahil olma olasılıkları önemli ölçüde düşük bulunmuştur. Tüm değişkenler göz önüne alındığında, kadınların finansal olarak erkeklere göre daha fazla dışlandığı, özellikle hesap sahipliği açısından önemli bir cinsiyet eşitsizliğinin var olduğu görülmektedir.

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1. Introduction

The spread of digitalization worldwide has led to revolutionary transformations by showing its effect in the economic and social fields. In this transformation, creating value with digital technologies has come to the fore and has an impact on all sectors. One of the sectors in which the influence of digital technologies is increasing gradually has been the financial services sector. In this sector; advanced technologies such as artificial intelligence and smart automation technologies have started to be used widely. Digital technologies included in the financial system have led to the emergence of digital financial products and services and digital identities, payment systems have become digital and diversified, and digital platforms that support the formation of digital infrastructure have emerged and become a part of digital transformation (Thathsarani and Jianguo, 2022). Along with the digital transformation, which is especially effective in the banking sector, digital formations such as Internet banking, mobile banking, branchless banking, and mobile wallets, where artificial intelligence applications are used, have been included in the financial system (Babarinde et al., 2020). Digital platforms and services have facilitated the participation and access of all segments of society to the financial system through mobile devices with widely used digital technologies.

Digital financial services, which have an important role in the growth of financial inclusion, have revealed the concept of "Digital Financial Inclusion (DFI)", which is a combination of digital technology and digital inclusive finance. “DFI comprises the financial services that meet the needs through digital tools of the population who are financially excluded, have difficulty accessing financial services, and cannot benefit from financial services adequately. It also involves financial services that are affordable for customers, sustainable for providers, and cost-saving (World Bank Group, 2014; Nandru et al., 2021). Among the reasons for exclusion of the financially excluded people are having not sufficient financial possibilities, religious reasons, not needing any financial services, having an account from one of a family member, physical distance from bank branches, expensive financial services, and lack of trust (Allen et al., 2016). Another reason for financial exclusion could be inequalities in access to digital services both nationally and internationally. In UNDP's Sustainable Development Goals, it is stated that almost more than four billion people, ninety percent of whom are in developing countries, still do not have access to the internet and therefore cannot access to digital services (Nandru et al., 2021). It is widely accepted that DFI should be ensured in order to remove the barriers to access to digital services and close the digital gap and that digital financial services will contribute to growth by promoting the growth of financial inclusion (Ghosh and Chaudhury, 2020). Digital technologies play an important role in the development of banking and financial services penetration, especially in developing countries, and pave the way for DFI (Nandru et al., 2021).

Financial and banking systems have become more efficient with digital financial technologies. Digital finance which causes transformation in the finance and banking industry refers to financial services offered through personal computers, mobile phones, other wearable and mobile technological devices, the internet, and digital payment systems. The digitalization of financial services can ensure that the transaction costs of these services are more convenient and economical compared to traditional banking services. Thereby, low-income and poor people particularly in developing countries, can be included in the official financial system and benefit from more comfortable and safe banking services. Thus, these people who are included in the financial system may save money and have easier access to credit. Digital finance also provides

many advantages to customers in terms of making financial decisions faster, having more control over personal finance, and providing the ability to receive and make faster and easier payments. However, in order to provide a digital financial environment, different actors such as financial technology providers, finance-banking institutions, agencies, mobile network operators, necessary technological infrastructure, retail chains, customers, and their participation in the system should be ensured (Durai and Stella, 2019).

The study conducted by Boston Consulting Group (BCG) stated that especially mobile financial services have a positive effect on financial inclusion, but this effect varies from country to country (BCG, 2011). Making the financial system more inclusive and accessible will also secure the people who have been financially excluded and have difficulties accessing the financial system, thereby facilitating their access to official finance. In this case, these financially excluded people will be able to increase their income, establish a business, make investments and save, contribute to economic activities, and thus support economic growth (Ghosh and Chaudhury, 2020).

High participation and inclusiveness in the financial system provide advantages such as lower bank account costs, stronger legal rights, and the creation of more politically stable environments (Allen et al., 2016). Despite the advantages of financial inclusion, a large proportion of the adult population still does not have a bank account (Ghosh and Chaudhury, 2020). There can be various negative effects of not having a bank account. For example, if not having a bank account, difficulties may be experienced in liquidity management and payments, and high fees may be incurred in the use of services such as money orders and checks to cash (Lusardi, 2011). The fact that approximately two-thirds of the adult population who do not have a bank account in the world have at least one mobile phone can facilitate access to mobile financial services and contribute to the growth of financial inclusion (Demirgüc-Kunt et al., 2018). In addition, increasing banking penetration with the help of digital platforms, mobile banking services, and other digital technologies, and providing the necessary infrastructure to use all these factors will increase financial inclusion (Ghosh and Chaudhury, 2020).

The issue of financial inclusion has become one of the priority agenda items, attracting the attention of both countries and international organizations on a global scale. For example, financial inclusion, which was accepted as one of the important components of global development at the G20 summit in 2010, emerged as a tool for inclusive economic growth (GPFI, 2015; Ghosh and Chaudhury, 2020). Also at the summit, the "Financial Inclusion Action Plan" was approved for financial inclusion, which is accepted as the main agenda of global development, and the establishment of the "Global Partnership for Financial Inclusion" was announced (GPFI, 2015). Afterward, financial inclusion has been among the official goals of more than sixty governments around the world and has been adopted as the main objective in the Development Agenda of the United Nations member states after 2015 (Sahay et al., 2015). In 2014, "Financial Access, Financial Education, Financial Consumer Protection Strategy, and Action Plans" came into effect in relation to financial inclusion, which has been internalized by being among the official targets in Türkiye as a developing market. This strategy and action plan which is in line with the innovative financial inclusion principles determined in the G20 intended to be developed financial inclusion. In this respect, it is aimed that financial products and services are spread more inclusively to all individuals and businesses, financially excluded people are included in the financial system, and financial inclusion is increased by increasing the quality and use of financial products and services (CBRT, 2014). This action plan also

focused on two issues, namely, that financial education should be inclusive of the whole society and the protection of consumers. In addition, Türkiye also took some important steps to increase the diversity of financial products and services with the "Istanbul International Financial Center Strategy and Action Plan" prepared by the State Planning Organization in 2009 (Bozkurt and Karakus, 2020). In this direction, issues related to identifying the determinants of financial inclusion and ensuring access to financial services by all the people of society have started to take place among the development goals.

According to the World Bank Global Findex data, it is stated the proportion of the adult population holding an account in an official financial institution in Türkiye increased between 2011 and 2017. This rate increased from 58 percent in 2011 to 57 percent in 2014 and to 68 percent in 2017. While Türkiye was slightly above the developing country average of 61 percent as of 2017, it remained close to the world average of 67 percent. Despite this, it is seen that Türkiye remains below OECD countries and upper-middle-income countries. However, the number of people actively using digital banking services has reached 90 million 579 thousand individuals both individual and corporate in 2022 in Türkiye. It is observed that there has been a significant increase in the number of those actively using digital banking services between 2017 and 2022. The number of people, which was 35 million in 2017, increased to 91 million in 2022 and increased by approximately 62 percent. The increase in mobile banking services was remarkable in this increase (TBB, 2022).

The purpose of this study is to examine and measure the use and accessibility of DFI in Türkiye. To that end, the data is divided into two categories: demographic variables and variables related to DFI, and was compiled from the Global Findex Database 2021. Considering the binary structure of the dependent variable, the probit model was used in the study.

This study aims to contribute to the empirical literature on financial inclusion in Türkiye by using a rich individual-level data set. It is thought that the research findings will be beneficial to policymakers and service providers in improving the current status of DFI and identifying the barriers in front of it. In addition, since it is observed that a wide variety of variables are used in most of the studies in the financial inclusion literature, which is the subject of studies at macro and micro scales, and mostly indices created and country comparisons are made, it is thought that determining the main determinants of DFI and evaluating them in a country-specific manner will contribute to the literature.

The rest of the study is organized as follows. In the second part of the study, the literature on DFI will be mentioned, in the third part, the data set and method will be emphasized, this part will be followed by the findings, and finally, the conclusion part will be given.

2. Literature Review

Financial inclusion, especially DFI, has become one of the determinants of development in developing countries. Moreover, the new term development goals focus on the development of these countries, the issue of financial inclusion has become an increasing area of interest for various researchers, policymakers, and financial sector stakeholders, and has been examined in many aspects in the literature. The subject of financial inclusion has also been included in various studies in Türkiye. However, to the best of our knowledge, there is a limited number of studies in the empirical literature on the determinants of DFI, especially in Türkiye.

Ozsuca (2019) analyzed the level and main determinants of financial inclusion for Türkiye by using the 2017 World Bank Global Findex individual level of data. The study focused on how the relationship between formal financial services usage and individual characteristics such as education, age, gender, and income. Moreover, explored how individual characteristics affect financially excluded people in Türkiye's perceived barriers to owning accounts. The results of the study reveal that the probability of having an official account and savings increases according to the characteristics of being more educated, richer, older, and a male. The other result of the study is the individual traits that drive the use of other traditional formal financial services and mobile banking are the same.

Gunduz and Ozyildirim (2019) calculated a financial inclusion index for the 81 provinces in Türkiye in the period 2011-2018. They aimed to reveal the proportion of people who don't use financial market instruments for various reasons and how wide the range of financial products and services can reach in Türkiye. They found that the index values that depict the financial system dimensions exhibit significant regional variations. For instance, while the provinces such as İstanbul, İzmir, Ankara, Antalya, and Muğla had the highest financial inclusion index value, Bingol, Şanlıurfa, Şırnak, Batman, and Muş were in the lowest index value category.

Dar and Ahmed (2020) aimed to reveal financial inclusion determinants, the barriers to the determinants of financial inclusion, and the informal financial activities' determinants in India. They used independent variables such as education, age, gender, and income and used the Probit model for the analysis. According to their results, education, income, gender, and age have a substantially effect on variety of financial inclusion factors. These factors also have an essential effect on borrowing and informal savings.

Rahimyar ve Curuk (2021) examined the determinants and current situation of financial inclusion in Türkiye by using a questionnaire method on 480 people. They analyzed the obtained data with Probit regression. According to their findings, the rate of account ownership which is the fundamental indicator for financial inclusion is the percentage of 89.8. They also indicated that people most commonly prefer borrowing from family members or friends and using a formal account in order to save their money. Moreover, they stated that a percentage of 69.8 of people benefited from insurance services the other factor of financial inclusion. In accordance with the regression results, the level of education and income of the people considerably affect formal savings and account ownership.

Habesoglu (2021) aimed to investigate financial inclusion specifically with regard to women in Türkiye. Within this scope, he aimed to answer the questions; of whether gender is an obstacle to financial inclusion and if the answer is yes, whether women's income level affects financial inclusion. He aimed to find with these questions whether women were excluded from the financial system in Türkiye. As a result, he found that approximately more than half of the women are excluded financially in Türkiye and there is a substantial divergence between men and women.

Sarigul (2021) analyzed the level of financial inclusion development of regions and provinces in Türkiye in the period from 2011-2018. In this analysis, he developed a financial inclusion index by using access and usage dimensions. According to the result of the study, the regions evaluated as very high, high, medium, low, and very low, and found that Istanbul has a very high index value in the years considered. The index values of the Aegean, Western

Marmara, and Western Anatolia were in the high index value category. While, the Mediterranean, Eastern Marmara, and Eastern Black Sea were in the medium index value, Western Black Sea was in a low category. Lastly, Southeast Anatolia and Middle East Anatolia were in the very low index values category of financial inclusion. Provinces' financial index values found that consistent with their included index values of regional.

Nandru et al. (2021) investigated DFI determinants in India and the effect of characteristics of the demographic on the usage and accessibility of DFI. They measured the usage and accessibility of DFI in relation to demographic properties such as gender, education, employment status, income, and age. They found that the factors of employment status, age, income, gender, and education have a substantial effect on accessibility. Moreover, these factors have a considerable impact on the use of the digital environment for financial transactions such as made payments and receipts through mobile devices or internet usage.

Anane and Nie (2022) examined determinants of the adoption of financial services by using the Logit model. They evaluated the level of adoption among the key socio-demographics. The result of the Logit model stated that factors such as awareness, transaction cost, effort expectancy, facilitating conditions, privacy, security, and self-efficacy affect the adoption of digital financial services positively and also increase the adoption of digital financial services in several ratios. Moreover, the findings showed a substantial disparity in adoption rates across important socio-demographic factors, such as education level, gender, place of residence (urban vs. rural), and administrative areas of Ghana.

3. Data and Methodology

In this study, we aimed to identify the determinants of DFI in Türkiye and determine how individual characteristics (gender, age, income, and education level) are related to account ownership, ownership of mobile money accounts, saving, and borrowing. To that end, the data was obtained from The World Bank Global Findex (2021) database published in June 2023. The data were collected from nationally representative surveys of about 128,000 adults over 15 years of age in more than 120 economies including the Türkiye during the COVID-19 pandemic.

The previous versions are from 2011, 2014, and 2017 and also include a variety of new series that measure financial resilience and health in addition to the use and accessibility of formal and informal financial services. Moreover, the data identifies the gaps in the usage and access to financial services by poor adults and women. The sample size is 1,000 individuals for Türkiye.

As the dependent variables are binary, we use the Probit models that have been estimated along with marginal effects to analyze the determinants of DFI. In an econometric model, if the dependent variable has a normal distribution, analyses can be performed with linear models. When the dependent variable is not normally distributed, the assumptions cannot be met if the variable has two or more categories. Therefore, analysis with linear models is insufficient. Approaches such as the linear probability model, logit, and probit models are used to estimate models with this structure.

Logit or probit models are generally preferred when the dependent variable is categorical. The main difference between these two models is that the tail of the logit distribution is slightly fatter than the probit model. That is, in the probit model, the conditional probability of Pi

approaches 0 or 1 more quickly than in the logit model (Gujarati, 2004; Gujarati and Porter, 2009). The standard normal distributions, which form the basis of probit, and the standard logistic, which form the basis of logit, both have a mean value of zero, but their variances differ; 1 for the standard normal (Gujarati, 2004). In other words, the main difference between the two models is that the logistic cumulative distribution function is used in the logit model, while the normal cumulative distribution function is used in the probit model. This is because in the probit model, the basic dependent variable, which is the non-binary version of the dependent variable "y", is assumed to have a normal distribution, while in the logit model, the basic dependent variable is distributed in the form of a logistic curve. This hypothetical variable Y* is transformed by the cumulative normal in probit or the logistic transformation in logit (Aldrich and Nelson, 1984). Another difference of the probit model is that the results obtained from the analyses made with the same data are closer to the asymptotes, which is more consistent, than the logit model.

The probit model, based on utility theory or rational choice approach developed by Mc Fadden, is one of the regression models in which the dependent variable takes values of 0 and 1 such as successful-unsuccessful, yes-no, present-absent, observed-not observed, that is, it has two categories (Gujarati, 2004; Gujarati and Porter 2009). If the dependent variable is binary structure and normally distributed, a probit model using the cumulative normal distribution function is needed. In the probit model, when interpreting the estimated parameter coefficients, marginal effects are usually taken into account to measure the effects of the independent variable on the expected value of the dependent variable. In other words, the instantaneous effect of a one-unit change in the independent variable on the estimated probability, when other variables are held constant, is measured by the marginal effect.

Accordingly, the following specification is employed in the empirical analysis:

$$DFI = \propto + \beta_1 Gender + \beta_2 Age + \beta_3 Income + \beta_4 Education + \varepsilon \quad (1)$$

In equation 1, DFI is a proxy represented by four different financial inclusion measures, namely, ‘ownership of bank account’, ‘mobile money account’, ‘formal savings’, and ‘borrowing’. The independent variables are individual characteristics that are expected to determine the DFI. Individual characteristics are mainly ‘gender’, ‘age’, ‘income’, and ‘education’. These variables are constructed as dummy variables, except for the variable age. Gender variable, for example, is measured using two categories; equal to one if an individual is a female and zero otherwise. Regarding income, we consider five different income quintiles and use four different dummy variables, each one measured using two categories. The dummy variable for the richest quintile is omitted. In an indicator divided into five equal groups, each group is known as a quintile. Each of quintile represents 20% or 1/5 of the indicator's value range. The lowest 1/5 of values from 0–20% of the range are represented by the first quintile. In other words, the first quintile group represents 20% of the population with the lowest income and the fifth quintile group represents the 20% of the population with the highest income. The values from 20–40% are included in the second quintile; 40–60% are included in the third quintile; 60–80% are included in the fourth quintile; and the top 1/5 of values from 80–100% are included in the fifth quintile. When data is regarded as a quintile, users can quickly compare indicator values by comparing an economy's position to other economies for which data is

available by quintile[1]. For instance, when income falls into the first income quintile-1, it equals one; otherwise, it equals zero; and so on for the remaining other dummies (Gosh and Chaudhury, 2020).

For education variables, we use two different dummies that are incorporated into the specification and omit primary education. The dummy variable is equal to 1 if the individual has completed secondary education, and 0 otherwise. The dummy variable is equal to 1 if the individual has completed tertiary education or more, 0 otherwise. We used the International Standard Classification of Education (ISCED 2011) for the classification in the education levels.

Finally, the individual's age (AGE) is included as an explanatory variable because it is assumed to have an effect accessing to financial inclusion. The age is measured parametrically using 'age in the number of years'. Moreover, the 'Agesquare' variable is included in the model as a control variable to determine whether it has a linear effect on DFI. Four probit regression equations are developed in order to study patterns of financial inclusion in Türkiye based on these individual-level data and analyzed using the Stata 17 software. The description of these variables and summary statistics are given in Table 1 and Table 2, respectively.

Table 1. Description of the Variables Used in The Estimation

Variable	Definition
Main Indicator of DFI	
Account ownership	The dummy variable equals one if the individual has an account in a financial institution, zero for otherwise
Ownership of mobile money account	The dummy variable equals one if the individual has a mobile money account, zero for otherwise
Saving	The dummy variable equals one if the individual saved using an account at a financial institution, zero for otherwise
Borrowing	The dummy variable equals one if the individual borrowed in the past year, zero for otherwise
Individual Characteristics	
Female	The dummy variable equals one if the individual is a female, zero for otherwise
Age	Age of the individual
Age squared	Square of the age of the individual
Income quintile 1 -poorest 20%	The dummy variable equals one if income is in the first quintile, zero for otherwise
Income quintile 2 – second 20%	The dummy variable equals one if income is in the second quintile, zero for otherwise
Income quintile 3 – third 20%	The dummy variable equals one if income is in the third quintile, zero for otherwise
Income quintile 4 – fourth 20%	The dummy variable equals one if income is in the fourth quintile, zero for otherwise
Secondary education	The dummy variable equals one if the individual has completed secondary education, zero for otherwise
Tertiary education	The dummy variable equals one if the individual has completed tertiary education or more, zero for otherwise

[1]Eurostat (2024), World Bank (2024).

Table 2. Descriptive Statistics of the Variables Used in the Estimation

Variable	Observations	Mean	Std. dev.
Account ownership	1000	0.798	0.4016
Ownership of mobile money account	1000	0.228	0.4197
Saving	1000	0.264	0.4410
Borrowing	1000	0.684	0.4651
Income quintile 1 – poorest 20%	1000	0.156	0.3630
Income quintile 2 – second 20%	1000	0.166	0.3722
Income quintile 3 – third 20%	1000	0.185	0.3884
Income quintile 4 – fourth 20%	1000	0.212	0.4089
Female	1000	0.448	0.4975
Age	1000	37.862	14.8167
Age square	1000	1652.848	1294.05
Secondary education	1000	0.487	0.5000
Tertiary education	1000	0.294	0.4558

Source: World Bank Global Findex Database.

4. Findings

The probit regression estimation for the influence of individual characteristics on DFI is presented in Table 3. The columns in the table represent the dependent variables as separate models (Model I, II, III, IV), and the rows represent the independent variables consisting of individual characteristics.

Table 3. Determinants of Financial Inclusion in Türkiye

	Model I	Model II	Model III	Model IV
	Account Ownership	Ownership of Mobile Money Account	Saving	Borrowing
Female	-0.1445***	-0.0744***	-0.0630**	-0.1353***
	(0.0253)	(0.0261)	(0.0280)	(0.0304)
Age	-0.0053	-0.0018	-0.0225***	0.0214***
	(0.0045)	(0.0051)	(0.0049)	(0.0054)
Age square	0.0001	-0.0000	0.0002***	-0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Income quintile 1 – poorest 20%	-0.2843***	-0.1215***	-0.2263***	0.0532
	(0.0580)	(0.0329)	(0.0256)	(0.0466)
Income quintile 2 – second 20%	-0.2076***	-0.0985***	-0.1994***	0.0199
	(0.0554)	(0.0342)	(0.0280)	(0.0472)
Income quintile 3 – third 20%	-0.1472***	-0.0451	-0.1433***	0.0380
	(0.0517)	(0.0355)	(0.0308)	(0.0446)
Income quintile 4 – fourth 20%	-0.1189**	-0.0135	-0.0928***	-0.0510
	(0.0486)	(0.0350)	(0.0322)	(0.0450)
Secondary education	0.1281***	0.1287***	0.0951**	0.1685***
	(0.0313)	(0.0423)	(0.0443)	(0.0405)
Tertiary education	0.1811***	0.1510***	0.1098**	0.2532***
	(0.0258)	(0.0511)	(0.051)	(0.0363)
Observations	1000	1000	1000	1000
Pseudo R2	0.1553	0.0667	0.1097	0.0658
Log likelihood	-424.9991	-501.0635	-513.9057	-582.7790

Note: The estimated coefficients are the marginal effects and numbers in parentheses indicate the standard error. ***, **, * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Considering the results, all the financial inclusion indicators indicate a significant relationship with the gender of an individual. Being female is found to be negatively significant for all of the financial inclusion indicators, implying the existence of a gender gap in the access and usage of financial services. While this result aligns with previous studies by Dar and Ahmed (2020), Ozsuca (2019), and Zins and Weill (2016), it differs from the findings of Rahimyar and Curuk (2021), who state that there is no statistically significant difference between women and men in terms of account ownership. Additionally, our findings that women are much less likely than men to have an account in Türkiye are consistent with the results found by Fungácová and Weill (2015) in China. Women's accounts ownership, savings, and borrowing rates in an official financial institution are lower than men's in Türkiye. Particularly, women in Türkiye are roughly 13% less likely than men to have formal borrowing, while they are 14% less likely than men to have an account at a financial institution. Among the reasons are lower rates of women's labor force participation, insufficient financial means, and generally being economically dependent on their families or spouses. In addition to these reasons, religious reasons, not needing any financial services, having an account from a family member, and expensive financial services can also be cited. Our findings regarding gender shows that gender has a significant impact on financial inclusion. It also confirms the fact that women tend to be more financially excluded than men due to barriers to entry into the formal financial system.

Considering the relationship between the age of the individuals and the DFI, it is seen that the age of an individual has a significant effect on 'Saving' and 'Borrowing'. People who have reached a certain age have a higher probability of borrowing in Türkiye than younger individuals. This means that the probability of saving is lower. However, the coefficient estimates for the 'Agesquare' variable are significant with positive and negative signs for the 'Saving' and 'Borrowing' variables, respectively. This result indicates that an individual's age has a significant effect on the probability of saving and borrowing but this relationship is not linear.

Regarding the level of income, the coefficient estimates for the four income quintiles are found to be negative and statistically significant. However, all income quintiles become statistically insignificant for the specification employing borrowing (Model IV) as the dependent variable. In the account ownership (Model I) and saving (Model III) with larger negative coefficients for lower income quintiles, the poorest 20 percent, second 20 percent, and third 20 percent, are found a significantly lower probability of being financially included.

The results obtained from Models I to IV show that coefficient estimates for education are positively significant for all financial inclusion variables. The dummy variable for tertiary education that has the highest coefficient value is a major significant determinant for all financial inclusion measures. It was observed that the value of coefficients increases with higher education level. In other words, individuals being tertiary education are considerably less likely to be financially excluded than individuals with secondary education. This result is similar to the studies investigated by Dar and Ahmed (2020), Nandru et.al. (2021), and Ozsuca (2019). They also stated in their studies that the level of higher education significantly affects higher financial inclusion.

Moreover, in this study, those with a tertiary degree or higher, in example, are roughly 18% more likely to have a formal account and 11% more likely to have saved using formal

methods. On the other hand, having a bank account and formal savings are 14 and 6 % less likely, respectively, if you're a woman.

Considering the relationship between the secondary and tertiary education levels of the individuals and the DFI, it is seen that both of education level also has a significant effect on the ownership of mobile money accounts. The individual has tertiary education or higher are approximately 18% more likely to have a formal account, 15% ownership of a mobile money account, 11% saving, and 25% borrowing. On the other hand, the individual who has secondary education is approximately 13% more likely to have a formal account, 13% ownership of mobile money account, 9% saving, and 17% borrowing. When comparing both education levels, especially in terms of borrowing, the individual who has a tertiary education level is more likely to have borrowing. Meanwhile considering the age, as individuals age, financial difficulties appear to be less of an issue, but new concerns for older adults include cost, trust, distance, and religion.

Based on the findings above, the regression analysis on overall samples emerges that gender, education, and income level are significantly related to financial inclusion. In terms of all the measures of financial inclusion aspects, females are significantly more financially excluded than males. In conclusion, individual characteristics seem to have a greater impact on account ownership and saving in particular, yet education is revealed as the most powerful predictor when the marginal effects are considered.

5. Conclusion

The main goal of this study is to identify the determinants of DFI in Türkiye and determine how individual characteristics (gender, age, income, and education level) are related to account ownership, ownership of mobile money accounts, saving, and borrowing. In this context, we measured DFI by examining the accessibility and usage of DFI in relation to selected demographic characteristics such as gender, age, income, and education. Variables in the study were broadly grouped into two categories demographic variables and variables related to DFI, and the data was collected from the Global Findex database to specify the determinants of DFI from Türkiye's perspective. Considering the binary nature of the dependent variable, the probit model was used to make inferences in the study. The findings of the study showed that individual characteristics such as gender, education, and income have a significant impact on DFI.

Education, more specifically tertiary education, was revealed as the most important determinant for all financial inclusion indicators. Regarding the level of income, for lower-income quintiles, in particular, the poorest 20 percent and the second 20 percent are found a significantly lower probability of being financially included.

Another important finding is that the probability of being financially included is lower for women. Women's accounts ownership, savings, and borrowing rates in an official financial institution are lower than men's in Türkiye. Among the reasons are lower rates of women's labor force participation, insufficient financial means, and generally being economically dependent on their families or spouses. In addition, considering the traditional role of Turkish women, it can be said that they have informal savings, which are called "under the pillow", especially in terms of savings. In addition to these reasons, religious reasons, not needing any financial services,

having an account from a family member, and expensive financial services can also be cited. Based on our gender-related findings, steps to be taken to remove the barriers to women's entry into the official financial system for various reasons in Türkiye will increase financial inclusion. These steps may include increasing women's employment, making policies to encourage women's participation in the financial system, increasing the level of formal education, and providing various pieces of training to increase financial literacy.

Türkiye has a significant potential to increase financial inclusion. Factors such as the high number of young people in Türkiye, the high rate of adaptation of these young people to new technologies, and the widespread use of mobile technologies and social media are influential in increasing this potential. Moreover, the increase in online shopping, mobile banking transactions and mobile payment platforms, and digital banking, especially with the COVID-19 pandemic, can be counted among the factors that increase the potential for high financial inclusion in Türkiye. The increase in Internet access from 42% to 88% between 2010 and 2019 in Türkiye, and significant increases in the use of services such as e-commerce, e-government, and Internet banking can also increase this potential.

The study's findings may contribute to the development of better policies to improve financial sector outreach by showing how different individual traits affect financial inclusion. In addition, developing policies to increase income and education levels and removing barriers related to income and education could help expand formal financial services, participation in these services, and use of these services. In this context, it is important to first increase formal education at all levels of education by reorganizing it according to the requirements of the digital age and to develop policies to ensure that girls are more included in the education and training system. Furthermore, importance should be given to campaigns to increase awareness of access to financial products and financial resources, to increase women's employment potential, and to develop policies to ensure the participation of women and the young population in the financial system.

In addition to this, whereas there may be various barriers to financial inclusion in some societies or countries, exclusion from financial inclusion may be voluntary or involuntary, as stated by Allen et al. (2016). Therefore, it is important to explain the difference between this voluntary and involuntary exclusion. For instance, in some societies, people may voluntarily excluded from financial inclusion due to “not having enough income,” “religious reasons,” or “having a family member own an account.” Involuntary exclusion can be expressed as a market failure. For example, distance to financial institutions, high financial transaction costs, excessive document requirements, and lack of trust can be expressed as involuntary exclusion. This distinction between exclusion from financial inclusion due to voluntary and involuntary barriers will also help in creating policy recommendations and will help develop policies that are appropriate to the structure of society. In addition, there may be cultural reasons behind the exclusion of women, in particular from financial inclusion in some societies. In such a case, the long distance of the bank, high costs, excessive document requirements, lack of trust, and religious reasons appear as less important obstacles for women. In this case, it can be concluded that the exclusion of women from financial inclusion is voluntary. Thus, as Aterido et al. (2013) have stated, in such a case, the gender gap in finance is not due to the finance sector itself but to the inclusion of women in the economy. Demirgüc-Kunt et al. (2013) also asserted that the gender gap in formal financial services access is caused by social and legal norms; additionally, Aterido et al. (2013) discoursed that female participation in the economy through formal

employment and education highlights the role of country characteristics influencing financial exclusion.

Lastly, the policymakers can develop efficient strategies that promote campaigns related to digital literacy or "d-literacy". This can be accomplished by raising awareness through the financial institutions' or service providers' embrace of digital payments. Both users and service providers will benefit from increased capacity building as a result of this program. Moreover, the providers of service must improve the users' ability to access their credit, debit, and mobile money accounts as well as their ability to use these accounts to pay for and receive services through card-based and mobile-based financial transactions. This can be enhanced with efficient support systems, sufficient technology infrastructure, and reasonable user fees.

Although there are many studies in the literature on financial inclusion and its potential benefits, due to the limited number of studies that reveal the main determinants of DFI for Türkiye, this study will contribute to the limited number of empirical literature and be an expansionist. For this reason, it is crucial to identify the determinants of financial inclusion in Türkiye and to expand financial services to include the whole society. The study findings will also guide developing and promoting financial inclusion in developing countries.

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 is no potential conflicts of interest in this study.

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