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Gender-inclusive development through fintech: Studying gender-based digital financial inclusion in a cross-economy setting

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ADB Working Paper Series

**GENDER-INCLUSIVE DEVELOPMENT
THROUGH FINTECH: STUDYING
GENDER-BASED DIGITAL FINANCIAL
INCLUSION IN A CROSS-ECONOMY SETTING**

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Abstract

Financial inclusion (FI) for vulnerable populations, such as women, is critical for achieving gender equality, women's empowerment, and thereby inclusive growth. In this regard, the use of digital financial services is of particular significance for women as it allows them easier access to financial products for business and household needs. For implementing policies to reduce the financial exclusion of women, it is necessary to first measure the extent of FI in a society. While there have been several attempts to measure FI for the general population, there is limited literature on gender-based measurement of FI. This paper fills this important research gap by developing a gender-based FI index (GFII) focusing particularly on digital services and evaluating the performance of economies across the globe (by considering 109 economies based on data availability) in terms of a gender-based FI measure developed by us. This index has been developed using two separate indices, a digital financial service index (DFI) and a conventional financial service uses index (CFI). One contribution of the paper is to relate the Gender Development Index (GDI) and the Gender Inequality Index (GII) of economies, two well-known measures of inclusive development, with the GFII and the DFI for females (DFIF). This exercise shows that while there is a positive correlation between these two sets of indicators, there are a number of economies that are high (or low) in gender development (or inequality), which need to improve their digital FI. Interestingly, using the Global Findex database and the Feasible Generalized Least Squares (FGLS) and instrumental variable panel data model, we show that health, education, the labor force participation rate, and political empowerment of women significantly impact the digital financial inclusion of women. The paper makes relevant policy suggestions for improving women's digital financial access and thereby enhancing gender empowerment for faster and more inclusive growth.

Keywords: digital financial inclusion, gender-based financial inclusion, inclusive growth, gender development index

JEL Classification: G2, G20, P34

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1. INTRODUCTION

Current global efforts have not made adequate progress on women's financial inclusion (FI), especially digital FI. Women are less likely than men to hold accounts, make use of credit, or access insurance facilities owing to barriers to accessing services from formal financial intermediaries (Demirgüç-Kunt et al. 2015, 2018) and a lack of identification documents, mobile phones, digital skills, financial capability, and appropriate financial products. Therefore, women are more vulnerable than men and face numerous hurdles in gaining access to essential resources such as education, healthcare, and tangible assets (Kabeer 2009). As a result, economic development is not robust and inclusive (Corrado and Corrado 2017; Dabla-Norris et al. 2015). Such exclusion in turn reduces their empowerment, freedom, and decision-making power in the household and in society (Corrado and Corrado 2017). Therefore, universal financial inclusion is important for realizing inclusive economic growth and welfare (Johnston and Morduch 2008).

Financial inclusion is a multi-stage process and its levels can be defined as having a bank account, regular use of the account, ease in making payments, and affordability of financial service access (Demirgüç-Kunt et al. 2015). In the modern era, financial services are increasingly reliant on digital infrastructure, and digitization of these services through computer programs and other technology, known as "fintech," has made them more accessible to a much wider range of communities and groups than ever before. In the context of empowering women financially, leveraging digital infrastructure is of paramount importance. Women often have limited mobility owing to societal and familial constraints, and fintech services can provide them with greater control over their financial resources. Improving access to credit through digital services can also allow women to become entrepreneurs and economically empowered to start and run businesses, which in turn can aid in their development and overall empowerment.

Quantifying the gender gap between men and women in several spheres has been attempted through the use of certain indices, viz., the Gender Development Index (GDI) (United Nations Development Programme 2018), the Gender Inequality Index (GII), and the Gender Empowerment Measure (GEM) (Government of India 2009).¹ These indices are well-known and accepted measurements of gender inequality. However, the link between these indices and gender-based financial inclusion indices is not adequately captured in the extant literature. Even though one can expect a relationship between these two sets of measures on average, a cross-economy study will reveal the differences in achievement of digital financial inclusion for otherwise similarly developed nations in terms of gender. As in the modern era financial services are increasingly reliant on digital infrastructure, such an exercise is expected to provide policy suggestions for different economies.

¹ The Gender Development Index, computed by the United Nations Development Programme, captures gaps in human development between men and women in health, knowledge, and living standards. It is the ratio of the HDI of women to the HDI of men, computed separately for a country. The UNDP also computes the Gender Inequality Index and measures gender inequalities in reproductive health, empowerment, and economic status. The higher the GII, the greater the inequality.

From the existing literature one finds that starting from Sarma (2008), a few recent studies such as Fanta and Makina (2019); Van et al. (2021); Nagpal et al., (2020); and Tram, Lai, and Nguyen (2021) have measured financial inclusion for various economies in the world. However, a limited number of studies (Asongu and Odhiambo 2018; Morsy 2020; Delechat et al. 2018) have attempted to measure gender-based financial inclusion at the cross-economy level.

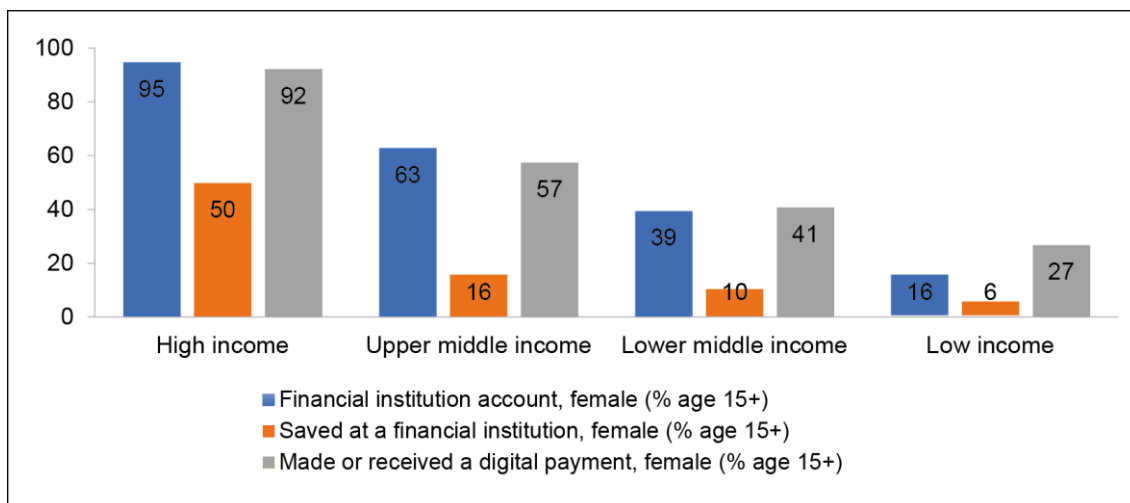
The core research agenda of the paper is to construct an index of gender-based FI (GFII) (comprised of two components, namely conventional a financial service usage index (CFI) and a digital financial service usage index (DFI)), examine their link to the GDI and the GII (though based on simple correlations, not a causality exercise), and then identify the drivers of financial inclusion (i.e., the GFII) focusing on the digital aspect. We calculate it for different economies for 2011, 2014, 2017, and 2021 using the Global Findex database (see Demirgüç-Kunt et al. 2018). It helps us to investigate the performance of different economies over the years in ensuring the financial inclusion of women and to observe how digital services have penetrated over the years. To investigate the drivers of the GFII, we consider several important indicators about women, such as life expectancy at birth, mean years of schooling, per capita income, the share of seats in parliament, and the labor force participation rate for this purpose. We use advanced econometric techniques such as the instrumental variable regression model for this task. Finally, relevant policy suggestions are put forth for the improvement of fintech-based financial inclusion for women in different economies around the world.

To construct the GFII we use the approach of principal component analysis (PCA) in which weights are endogenous estimates through specific model assumptions (Elsherif 2019; Sha'ban, Girardone, and Sarkisyan 2020; Tram, Lai, and Nguyen 2021). This is better than the other approach, where the weights assigned to each dimension are selected in an ad hoc manner (e.g., Sethi and Sethy 2019; Huang and Zhang 2020). Therefore, the use of the PCA method provides more robust results.

Before constructing the indices, we first look at the levels of financial service usage by women using the Global Findex database 2017 (Demirgüç-Kunt et al. 2018). Our analysis showed that female participation in the financial system varies with the income level of a country. For instance, 92% of women made or received digital payments in high-income economies, while it was only about 27% in low-income economies (Figure 1) in 2021. However, one phenomenon amongst the lower-middle- and low-income economies is worth noting. In both these categories, the percentage of women having a bank account in a formal bank is lower than the percentage of women using digital platforms for financial transactions. This shows that in low-income economies, the digital channels of financial transactions have relatively greater importance than conventional modes. This may be due to a lack of adequate bricks and mortar infrastructure or a higher level of societal restrictions faced by women. However, among low-income nations too, there are significant variations. For example, among these economies, the percentage of women that had saved at a financial institution was about 11% in Mali, whereas it was as low as 0.13% in Afghanistan in the same period. Therefore, given the varied experiences of economies, measuring the gender-based financial inclusion index across nations is a worthwhile exercise.

It is also vital to know whether or not economies are improving their position in terms of the adoption of technologies for financial access, along with their overall development process.

Figure 1: Women’s Participation in the Financial System and Digital Platform in 2021



Source: Authors’ calculation using the Global Findex database (<https://www.worldbank.org/en/publication/globalfindex/Data>).

Our work can be applied to ascertain the country-level GFII as well as the digital financial inclusion of the female population, the DFIF, to understand a country’s positions in different years. Different economies can focus on the important determinants considered in this study for improving their rank concerning the GFII and in particular the DFIF. Finally, our study could be used to derive policies for empowering women through financial inclusion through digital platforms for inclusive development.

The structure of the paper is as follows. The next section provides an overview of the literature on financial inclusion and the construction of indices to measure it. We examine studies that have looked at disparities in financial access between men and women. It is found that most studies do not use or construct any comprehensive measure (index). We bridge this research gap in Section 3 by creating appropriate indices using World Bank data. Section 4 uses the index of gender-based financial inclusion to build an econometric model to assess the impact of country-level factors on women’s financial inclusion, focusing on questions such as whether lower national gender development leads to lower financial inclusion, and if so, which components are influential? The results of this exercise are discussed in Section 5, and concluding remarks are presented in Section 6.

2. REVIEW OF LITERATURE

Financial inclusion is widely found to be a significant determinant of a country's economic development and sustainability (Ambarkhane, Singh, and Venkataramani 2020; Makina and Walle 2019; Otiwu et al. 2018; Ahamed and Mallick 2019; Saha and Dutta 2021; Tchamyou2020) as well as an important tool for poverty alleviation and the improvement of standards of living (Singh and Kodan 2011; Van de Werff, Hogarth, and Peach2013; Ayyagari and Beck 2015; Iyer 2015; Okoye et al. 2017). While analyzing the state of financial inclusion, several studies have found that women are widely excluded from the financial system, owing to a variety of factors, such as limited education, income, and employment status (Demirgüç-Kunt, Kane, and Laeven 2014), and a general lack of empowerment (Efobi, Tanaken, and Asongu 2018; Stewart and Sanman 2014). However, the rapid digitization of financial services in the modern era has been seen by many scholars as an important tool for reducing disparities between men and women in financial inclusion (Amidžić, Massara, and Mialou 2014; Gammage et al. 2017; World Bank 2020; Chen et al. 2021). Several approaches have been adopted towards studying this gap between the genders in financial inclusion. For example, Fanta (2016) uses descriptive statistics and a binary logistic regression model to capture the effect of gender on access to savings, credit, education, and income levels. On the other hand, Botric and Broz (2017) used Fairlie decomposition to identify and decompose the gender gap in financial inclusion in central and southeastern Europe using World Bank data. However, these scholars only look at the individual components of financial inclusion, such as having a savings bank account or access to credit, and do not provide any aggregated measure of the disparities between men and women in this area. An aggregated measure, such as a gender-based index of financial inclusion, would assist in better understanding the roots of the issue and allow better policy formulation. Thus, it is interesting to build a gender-based financial inclusion index.

In order to undertake this, we study the efforts made towards building indices of financial inclusion. Appendix Table A1 summarizes the different ways in which indices of financial inclusion have been constructed.

We can see two common approaches to constructing an index in Appendix Table 1. The first finds the average distances (such as Euclidean distances) of the components included for measuring FI from an ideal value using the distance formula. The second uses principal component analysis (PCA) to identify the important contributors to an underlying indicator of financial inclusion. The former fall into the category of methods, where different constituents of financial inclusion are used as components and a weighted average or a Euclidean distance from a reference ideal is calculated (Gupte, Venkataramani, and Gupta 2012; Kaur and Abrol 2018; Prastowo and Putriani 2019; Sarma 2016; Sethi and Sethy 2019; Huang and Zhang 2020). The final index is sensitive to the selection of weights. While many studies have made use of methods that involve selecting weights by the researcher(s), recent efforts have been directed towards using approaches such as PCA where weights are data determined (Mialou et al. 2017; Cámara and Tuesta 2017; Park and Mercado 2018b; Yorulmaz 2018; Ahamed and Mallick 2019; Anarfo et al. 2019; Elsherif 2019; Sha'ban, Girardone, and Sarkisyan 2020; Tram, Lai, and Nguyen 2021). Bearing in mind the advantages of PCA, we use this method for constructing our index. In the next section, we detail the methodology used to construct the GFII.

3. MEASUREMENT OF GFII AND DFIF

3.1 Data Sources and Research Models

3.1.1 Data

We use the Global Findex Database 2021 to measure the overall financial inclusion index for women for the years 2011, 2014, 2017, and 2021. Based on data available for men and women, we consider nine indicators for measuring the GFII. Different indicators are available in different years, and the latest year includes more indicators than previous years. Also, based on data availability for different economies for different years, we calculate the GFII for 109 economies as only these have consistent data for different years.

3.1.2 Approach towards Constructing GFII and DFIF

In the literature, one observes that the FI index is often constructed using the indicators of financial infrastructure, such as the number of bank branches. However, when we consider the financial inclusion of vulnerable populations such as women, having infrastructure does not necessarily imply that women access financial services through the present infrastructure. Bearing this important aspect in mind, we have considered only those indicators for constructing indices that reveal the actual usage of financial services.

Therefore, we have constructed two indices: digital access and conventional method-based access through, for example, bricks-and-mortar branches of banks. These two indices, viz., the DFI and the CFI, are indeed usage-based indices. We combine these indices to arrive at the overall FI index (FII). These indices are constructed for males and females separately as in the case of the UNDP's gender development index, and then, based on these, we arrive at the GFII. Figure 2 presents a methodological flowchart of this.

As previously mentioned, we adopt the PCA method for the measurement of FI. Based on the PCA, we calculate the appropriate weights and postulate that the latent variable is linearly determined as follows:

$$FII_i = w_1DFI_i + w_2CFI_i + e_i \quad (1)$$

where FII_i is the overall financial inclusion index in economy i ; w_1 and w_2 are the relative weights of the two subindices; and e_i is the variation due to error.

The DFI and CFI are computed as follows:

$$DFI_i = \alpha_1X_{1i} + \alpha_2X_{2i} + \alpha_3X_{3i} + \alpha_4X_{4i} + \alpha_5X_{5i} + u_i \quad (2)$$

$$CFI_i = \beta_1X_{6i} + \beta_2X_{7i} + \beta_3X_{8i} + \vartheta_i \quad (3)$$

Figure 2: Methodological Flow Chart



Source: Authors.

Indicators used to compute these two subindices are presented in Table 1.

It is important to note that we calculate the FII for males and females separately by considering the indicators for males and females as shown in Table 1, and arriving at gender-wise DFI and CFI indices.

Table 1: Explanation of Variables Considered for the Measurement of Different Financial Indices for Different Years

| Variables | Indicators | |
|---|--|--|
| | Male | Female |
| Digital financial service usage index (DFI) | | |
| X1 | Owns a credit card, male (% age 15+) | Owns a credit card, female (% age 15+) |
| X2 | Owns a debit card, male (% age 15+) | Owns a debit card, female (% age 15+) |
| X3 | Borrowed any money from a formal financial institution or using a mobile money account, male (% age 15+) | Borrowed any money from a formal financial institution or using a mobile money account, female (% age 15+) |
| X4 | Mobile money account, male (% age 15+) | Mobile money account, female (% age 15+) |
| X5 | Made or received a digital payment, male (% age 15+) | Made or received a digital payment, female (% age 15+) |
| Conventional financial service usage index (CFI) | | |
| X6 | Financial institution account, male (% age 15+) | Financial institution account, female (% age 15+) |
| X7 | Saved at a financial institution, male (% age 15+) | Saved at a financial institution, female (% age 15+) |
| X8 | Borrowed from a formal financial institution, male (% age 15+) | Borrowed from a formal financial institution, female (% age 15+) |

Notes: 1. Variables X3, X4, and X5 are not available for 2011.

2. Variable X3 is not available for 2014 and 2017.

Source: The Global Findex database 2021.

3.2 PCA Methodology

The FII is computed by estimating a two-stage PCA:

- **The first stage of PCA:** Estimation of the two subindices, the DFI and the CFI, and the parameters (α and β) in the system of Equations (2) and (3). We estimate them using the principal components as linear functions of the independent variables. These two subindices are computed for males and females separately.
- **The second stage of PCA:** By considering the same procedure as in the first stage, we estimate the weights of the two subindices and combine them. We arrive at the FII index for males and females separately.

To present the computation procedure of the GFII we now introduce the notations FII_M_i and FII_F_i that represent the overall FII for males and females, respectively, for economy i .

$$GFII_i = \left(\frac{FII_F_i}{FII_M_i} \right) \times \left(\frac{FII_M_i + FII_F_i}{2} \right) \tag{4}$$

Based on data availability, we have calculated $GFII_i$ for the years 2011, 2014, 2017, and 2021, separately.

3.3 Estimated FII Index for Women

Table 2 presents the descriptive statistics of the indicators used to measure the FII for the year 2021². To ensure that the scale on which the indicators are measured is consistent, we normalize the indicators for each index before applying the PCA factoring by using the following formula;

$$\text{Dimension index}_i = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}} \quad (5)$$

Data after normalization takes values from 0 to 1, where 0 indicates the lowest level of financial inclusion and 1 indicates the highest level.

Table 2: Descriptive Statistics of the Variables Used to Measure the GFII in 2021 (in %)

| Variable | Male | | | | Female | | | |
|----------|------|-----------|------|-------|--------|-----------|------|-------|
| | Mean | Std. Dev. | Min. | Max. | Mean | Std. Dev. | Min. | Max. |
| X1 | 24.0 | 22.4 | 0.0 | 82.1 | 20.9 | 22.4 | 0.0 | 83.4 |
| X2 | 55.3 | 31.6 | 2.5 | 99.1 | 49.8 | 33.7 | 0.3 | 98.9 |
| X3 | 29.5 | 18.4 | 3.4 | 80.8 | 25.3 | 18.9 | 0.8 | 81.2 |
| X4 | 13.8 | 19.1 | 0.0 | 71.4 | 11.0 | 16.6 | 0.0 | 66.0 |
| X5 | 69.3 | 25.4 | 11.9 | 100.0 | 63.1 | 28.9 | 4.0 | 100.0 |
| X6 | 69.8 | 28.2 | 14.8 | 100.0 | 64.5 | 31.6 | 4.7 | 100.0 |
| X7 | 29.4 | 22.0 | 1.0 | 80.6 | 25.4 | 22.7 | 0.1 | 78.9 |
| X8 | 28.2 | 19.2 | 3.4 | 80.8 | 24.4 | 19.3 | 0.8 | 81.2 |

Note: The calculation is based on a sample of 109 economies.

See Table 1 for the variable definition.

Source: Calculated by authors.

3.3.1 First-Stage PCA Results

Before performing PCA analysis, we evaluated and ensured the validity of the data. Validity refers to the closeness of the measured values. We measured the validity using the Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity. We used STATA version 14 (Stata Corp, College Station, TX, US) to perform the KMO test and Bartlett's test of sphericity and, in both cases, found that PCA is appropriate for the analysis. The relevant statistics can be found in Appendix Table A2.

To find the weights to estimate Equations (2) and (3), we estimated the eigenvalues displayed in Table 3 using the PCA technique. Based on Kaiser (1960), we consider eigenvalues greater than 1 for the principal component analysis. Table 3 shows the eigenvalues of the principal components for both subindices for males and females separately for 2021. Except for the first principal component (comp1 of both subindices), none has an eigenvalue greater than 1. Therefore, the first components are considered for analysis. The weights obtained from the PCA analysis are assigned to the first principal component of each subindex. The estimations are consistent for the years 2011, 2014, and 2017 (see Appendix Table A3, Appendix Table A4, and Appendix Table A5).

² Descriptive statistics for the other three years, i.e., 2011, 2014, and 2017, are not presented here due to space constraints.

Table 3: Principal Component Estimates for Different Financial Indices for 2021

| Male | | | | |
|------------------|-------------------|-------------------|-------------------|-------------------|
| Component | Eigenvalue | Difference | Proportion | Cumulative |
| <i>DFI</i> | | | | |
| Comp1 | 3.63962 | 2.75713 | 0.7279 | 0.7279 |
| Comp2 | 0.882481 | 0.493601 | 0.1765 | 0.9044 |
| Comp3 | 0.388881 | 0.340041 | 0.0778 | 0.9822 |
| Comp4 | 0.048839 | 0.008657 | 0.0098 | 0.992 |
| Comp5 | 0.040183 | . | 0.008 | 1 |
| <i>CFI</i> | | | | |
| Comp1 | 2.60255 | 2.38013 | 0.8675 | 0.8675 |
| Comp2 | 0.222424 | 0.047402 | 0.0741 | 0.9417 |
| Comp3 | 0.175022 | . | 0.0583 | 1 |
| <i>FII</i> | | | | |
| Comp1 | 1.9796 | 1.95919 | 0.9898 | 0.9898 |
| Comp2 | 0.020403 | . | 0.0102 | 1 |
| Female | | | | |
| Component | Eigenvalue | Difference | Proportion | Cumulative |
| <i>DFI</i> | | | | |
| Comp1 | 3.56811 | 2.64554 | 0.7136 | 0.7136 |
| Comp2 | 0.922572 | 0.496383 | 0.1845 | 0.8981 |
| Comp3 | 0.426189 | 0.383193 | 0.0852 | 0.9834 |
| Comp4 | 0.042996 | 0.002862 | 0.0086 | 0.992 |
| Comp5 | 0.040134 | . | 0.008 | 1 |
| <i>CFI</i> | | | | |
| Comp1 | 2.58152 | 2.32661 | 0.8605 | 0.8605 |
| Comp2 | 0.254906 | 0.091333 | 0.085 | 0.9455 |
| Comp3 | 0.163574 | . | 0.0545 | 1 |
| <i>FII</i> | | | | |
| Comp1 | 1.97757 | 1.95513 | 0.9888 | 0.9888 |
| Comp2 | 0.022435 | . | 0.0112 | 1 |

Source: Calculated by the authors.

Table 4 displays the weights obtained from the information in the principal components and the corresponding eigenvalues. For the DFI subindex, X1 (owns a credit card) and X2 (owns a debit card) have higher weights than other indicators for males and females. On the other hand, for the CFI subindex, X7 (saved at a financial institution) has higher weights than X6 (financial institution account) and X8 (borrowed from a formal financial institution), though the difference is very small. Similarly, we present results for 2011, 2014, and 2017 in Appendix Table A6, Appendix Table A7, and Appendix Table A8).

Table 4: Scoring Coefficients for Orthogonal Varimax Rotation (Weights) for 2021

| Variable | Male | | Female | |
|------------|---------|-------------|--------|-------------|
| | Comp1 | Unexplained | Comp1 | Unexplained |
| <i>DFI</i> | | | | |
| X1 | 0.4981 | 0.09692 | 0.5028 | 0.09779 |
| X2 | 0.4843 | 0.1462 | 0.4874 | 0.1525 |
| X3 | 0.4798 | 0.1622 | 0.4807 | 0.1755 |
| X4 | -0.2588 | 0.7561 | -0.225 | 0.8194 |
| X5 | 0.4692 | 0.1989 | 0.4774 | 0.1867 |
| <i>CFI</i> | | | | |
| X6 | 0.5724 | 0.1474 | 0.5694 | 0.1629 |
| X7 | 0.5822 | 0.1177 | 0.5878 | 0.108 |
| X8 | 0.5774 | 0.1323 | 0.5747 | 0.1475 |
| <i>FII</i> | | | | |
| DFI | 0.7071 | 0.0102 | 0.7071 | 0.01122 |
| CFI | 0.7071 | 0.0102 | 0.7071 | 0.01122 |

Source: Calculated by the authors.

3.3.2 Second-Stage PCA Results

In the second stage, by carrying out the same procedure as in the first stage, we apply the PCA method to the two subindices (DFI and CFI) to calculate their weights in the overall FII. Table 3 shows the results of principal component estimates for the FII. The results show that only the first component has an eigenvalue greater than 1 for males and females. Therefore, only the first component is considered for analysis. The KMO results in Appendix Table A2 show that PCA analysis is relatively suitable. Similarly to the method in the first stage, we also calculated weights for both dimensions, which are presented in Table 4. In considering values of weights, we find that two subindices are equally important for explaining the level of financial inclusion. Similarly, we estimate the overall FII for males and females separately for 2011, 2014, 2017, and 2021 for different economies in the world. Finally, following the estimation procedure explained in Equation 4, we calculate the GFII.

3.4 Ranking of Economies Based on Different Indices

In considering the DFIF, we observe that Canada; Hong Kong, China; the United States; Israel; New Zealand; the Republic of Korea; Austria; Japan; the United Kingdom; and Finland assume the top ten positions. On the other hand, Afghanistan, Pakistan, Iraq, Sierra Leone, Guinea, Lebanon, Tanzania, Benin, Burkina Faso, and Zimbabwe occupy the bottom ten positions. We also find that economies like Thailand, Sri Lanka, India, South Africa, and Malaysia rank better in the CFI but lower in the DFI for women.

Appendix Table A9 presents the ranking of the economies according to the estimated values of the GFII for women. Rank 1 indicates that the economy is the best in terms of financial inclusion for women, and subsequently, higher ranks indicate a lower level of financial inclusion for women. The table shows that in 2021, the top ten economies with the highest financial inclusion for women (as per the GFII index) in the sample are Canada; Hong Kong, China; the United States; Australia; New Zealand; Israel; the United Kingdom; Germany; Ireland; and Japan. It is important to note that these are all high-income economies. The ten economies with the lowest financial inclusions for

females in the sample are Ecuador, Afghanistan, Pakistan, Iraq, Lebanon, Guinea, Tanzania, Sierra Leone, Gabon, and Benin. Interestingly, among the economies that belong to the high- or upper-middle-income group but still have a relatively lower GFII are Ecuador, Iraq, the United Arab Emirates, Greece, and Saudi Arabia.

Subsequent computation of Spearman's rank correlation to understand the association over the years reveals that the coefficient between the ranking of economies in 2011 and 2014 is 0.9427, which is statistically significant at a 1% level. The rank correlation between 2014 and 2017 is 0.9446, which is also statistically significant at the 1% level. The rank correlation between 2017 and 2021 is 0.9436 at the 1% level of significance. This indicates that the rankings of economies do not vary much over the years.

To understand the changes in ranking in different years with regard to the use of financial technology, we calculate the differences in ranking of economies from 2011 to 2021. Positive differences indicate that the economy has improved in terms of higher financial inclusion for females from 2017 to 2021, while negative differences indicate worsened conditions. Among the 39 high-income economies, Italy; Uruguay; Chile; Hong Kong, China; Japan; Israel; Spain; Germany; the United States, and Poland have the highest positive differences between rankings. On the other hand, Saudi Arabia, Sweden, Slovenia, the Netherlands, Croatia, the United Arab Emirates, Lithuania, Denmark, Belgium, and Malta show the highest negative differences. Among eight low-income economies, Mali, Uganda, and Togo show the highest positive differences, whereas Malawi, Sierra Leone, Burkina Faso, and Afghanistan confirm the highest negative differences. Among 31 lower-middle-income economies, Tajikistan, India, Senegal, and Ukraine show the highest improvement, whereas Zimbabwe, Tanzania, Zambia, and the Philippines experience the lowest improvement. Among 31 upper-middle-income economies, Bosnia and Herzegovina, Kazakhstan, Venezuela, Moldova, the Russian Federation, the People's Republic of China (PRC), and Bulgaria show the best enhancement. Costa Rica, Ecuador, Kosovo, Mauritius, and the Dominican Republic experienced the lowest enhancement in female financial inclusion.

Finally, among 109 economies, Bosnia and Herzegovina, Italy, Kazakhstan, Venezuela, Mali, Tajikistan, Uruguay, and India show the highest improvement. In contrast, Costa Rica, Ecuador, Zimbabwe, Tanzania, Saudi Arabia, and Malawi show the lowest improvement in financial inclusion for females. On the other hand, Australia, Canada, Portugal, Brazil, and Malaysia do not show any ranking change from 2014 to 2021.

The construction of the DFIF and the GFII and the ranking of economies provides useful insights into gender deprivation in terms of financial access. It is interesting to examine whether a lack of gender development in terms of education, income, or ability to participate in sociopolitical programs contributes towards such exclusion. It led us to scrutinize how our GFII is related to the already established gender development index (GDI) and gender inequality index (GII) of the respective economies.

3.5 Region-Wise Analysis of DFIF and GFII from 2017–2021

After country-wise ranking, we assess the region-wise changing pattern of the DFIF and GFII from 2017 to 2021. A simple average is computed by using the respective indices of economies of a region to arrive at the corresponding region-specific index (Table 5).

Table 5: Region-Wise Average of Calculated Values of DFIF and GFII

| Region | DFIF | | GFII | |
|-----------------|--------|--------|--------|--------|
| | 2017 | 2021 | 2017 | 2021 |
| Africa | -1.375 | -1.366 | -1.394 | -1.355 |
| Asia | -0.075 | -0.034 | 0.251 | 0.066 |
| Central America | -0.898 | -1.130 | -0.883 | -1.287 |
| Europe | 0.894 | 0.891 | 0.902 | 0.889 |
| Middle East | -0.237 | -0.340 | -0.339 | -0.373 |
| North America | 2.778 | 2.738 | 2.842 | 2.854 |
| Oceania | 2.520 | 2.388 | 2.633 | 2.620 |
| South America | -0.347 | -0.222 | -0.391 | -0.447 |

Source: Computed by authors.

Table 5 shows that the most developed regions, including Europe, North America, and Oceania, performed well in the DFIF and GFII. On the other hand, Africa, Central America, and South America performed worst in both indices. Interestingly, Asia performed better than these regions, including the Middle East. Some regions improved their scores between 2017 and 2021 (namely Africa, Asia, and South America) in the DFIF over the GFII. On the other hand, Central America and the Middle East regressed (in ranking) during the same period and hence need special attention from the policymakers.

Looking in particular at the Asian region, it is clear that East Asia (including Japan, the PRC, and the Republic of Korea) performs best, while West Asia (including Afghanistan, Iran, and Iraq, among others) is the worst according to the 2021 data in Table 6. In terms of the overall index (GFII), improvements were observed in East Asia and South Asia while the other regions fared worse in 2021 than in 2017. Digital indices, however, show improvements in many of the subregions of Asia.

Table 6: Digital and Overall Index Comparisons between Asian Regions

| Subregion in Asia | DFIF | | GFII | |
|-------------------|--------|--------|--------|--------|
| | 2021 | 2017 | 2021 | 2017 |
| East Asia | 2.164 | 1.924 | 2.243 | 2.088 |
| North Asia | 0.457 | 0.230 | 0.934 | 2.315 |
| South Asia | -1.043 | -1.112 | -1.007 | -1.113 |
| Southeast Asia | -0.084 | -0.022 | -0.046 | 0.102 |
| West Asia | -1.220 | -1.082 | -1.176 | -1.024 |

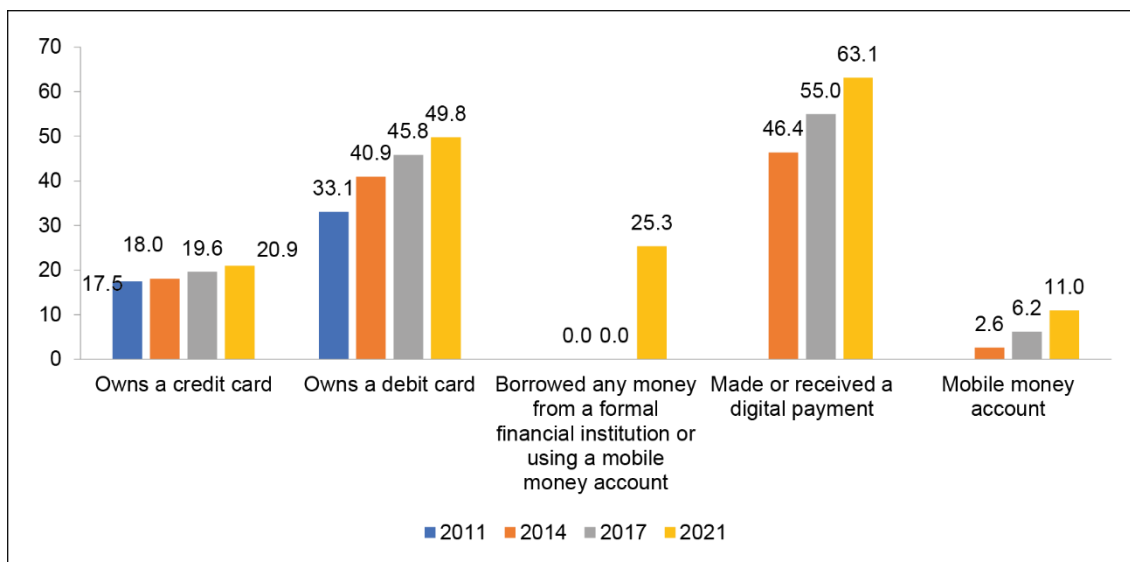
Source: Computed by authors.

3.6 Relationship between DFIF and GFII

After observing different trends between the DFIF and the GFII over the years, it is of interest to examine whether there is any correlation between the DFIF and the GFII. As the DFIF is used to construct the GFII it may not be appropriate to compute a usual correlation coefficient between these two measures. It may be more apt to calculate the rank correlation between economies for different years based on these two indices. Our computation reveals that the rank correlation between two indices is as high as 0.95 (or 0.98 or 0.99 or 0.99) for 2011 (or 2014 or 2017 or 2021). These rank correlation coefficients over the years have also been statistically significant at the 1%

level. This indicates that if the rank of an economy based on the DFIF is higher, the same economy also ranks high in terms of the GFII. This leads to the conclusion that the gender-based digital financial index is important in improving the overall financial inclusion for women.

Figure 3: The Increasing Trend in Components of DFIF



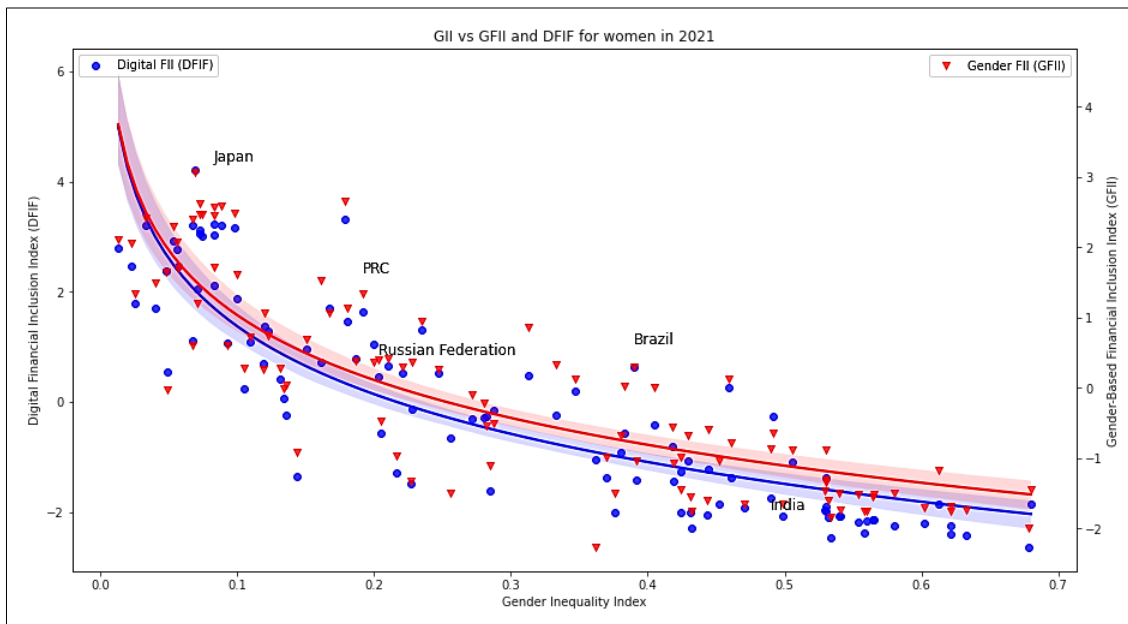
Source: Authors.

Moreover, Figure 3 demonstrates that the DFIF’s component parts are on the rise. Women’s ownership of credit cards, for instance, increased from 17.5% in 2011 to 20.9% in 2021. During the same period, the number of women who “made or received a digital payment” climbed by roughly 17%. A 25% increase in the proportion of women who “borrowed any money from a formal financial institution or through a mobile money account” is also estimated for 2021. Female account ownership of mobile money increased from 2.6% in 2014 to 11% in 2021. The rising trend shows that female financial inclusion digitally is rising gradually, and this has a big impact on financial inclusion for women as a whole.

3.7 How Are the DFIF and GFII Indices Related to GDI and II?

Figure 4 depicts the association between the Gender Inequality Index (GII, higher figures imply greater inequality) and the estimated GFII Index. A negative relationship between the two indices reveals higher gender inequality associated with greater financial exclusion for women. The correlation coefficient between these indicators is -0.85 , and it is statistically significant (at a 1% level). However, from the developing economies’ perspective, the PRC and the Russian Federation present a much better position than Brazil and India. Therefore, the correlation seems to vary among and within the different groups of economies separated by income. On the other hand, higher gender inequality correlates to a greater exclusion of the digital financial inclusion index too.

Figure 4: Relationship between GII and Estimated GFII and DFIF for Women in 2021

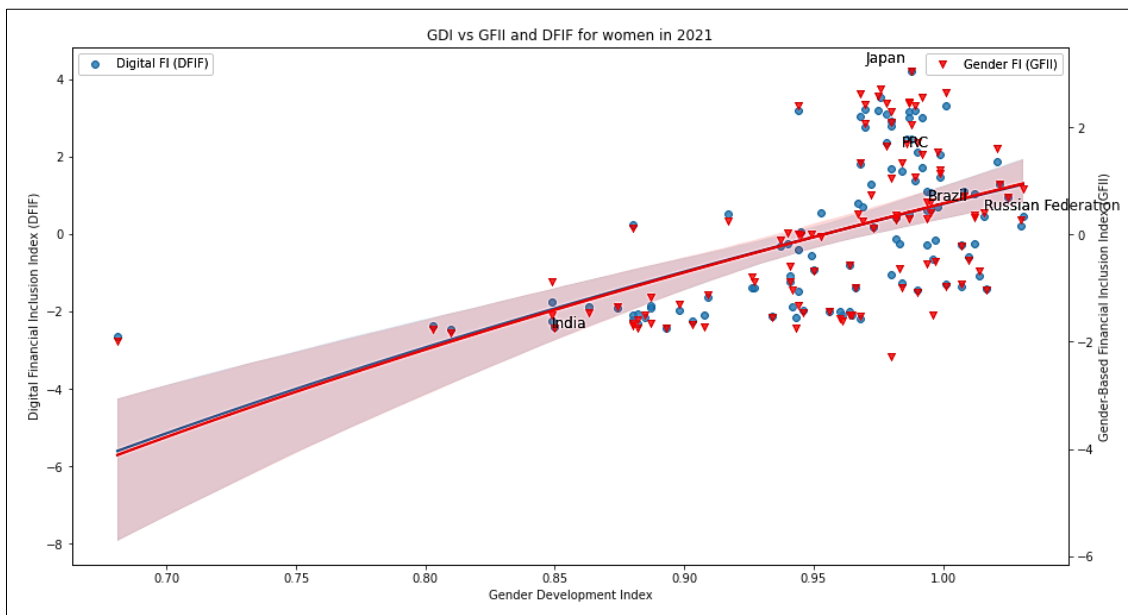


Note: Chart uses $y \sim \log(x)$ regression for mean estimates (blue and red lines).

Source: Authors' calculation.

On the other hand, as expected, a positive relationship is revealed between the GDI and estimated GFII in Figure 5. This implies that higher achievement in the basic dimensions of human development for women promotes higher financial inclusions for them. The graph shows that the GFII and the DFIF almost coincide. If we compare similar graphs for the year 2017 (graphs not shown due to space constraints), another interesting feature can be noted: Namely, the differences between the two curves based on the GFII and the DFIF have reduced in 2021 compared to 2017 (against both the GDI and the GII). This quantitatively establishes that over time the usage of digital financial services dominates for economies across the globe. The correlation coefficient between these two indicators is 0.53, which is statistically significant at a 1% level. The results show that the GII components (comprising reproductive health, political and labor market participation, and a higher level of education) have more compatible relations than the GDI components (comprising longevity of life, basic education, and income per capita) with the financial inclusion of women. We can see in Figure 5 that similar levels of GDI values among economies are associated with significantly different levels of financial inclusion for women. This indicates that women’s empowerment in terms of political and labor market participation and higher education levels make a significant difference in achieving women’s financial inclusion. On the other hand, a higher GDI indicates a higher inclusion in the DFIF.

Figure 5: Relationship between GDI and Estimated GFII and DFIF in 2021



Note: Chart uses $y \sim \log(x)$ regression for mean estimates (blue and red lines).

Source: Authors' calculation.

As a next step, we move to a more disaggregated analysis to see whether all components of gender development play a significant role in enhancing FI. Secondly, we ask whether infrastructure is an important variable in determining the GFII. To investigate this, we employ a panel data regression model to understand the impact of different country-level development factors on women’s financial inclusion.

4. DETERMINANTS OF GFII

4.1 Econometrics Model Specification

Our econometric model to investigate the determinants of the GFII (as well as the DFIF) takes the following representation:

$$GFII_{it} = \beta_0 + \beta_i Z_{it} + \delta_t + \eta_i + \epsilon_{it} \tag{6}$$

where Z_{it} represents the set of independent variables for economy i at time t ; η_i is the unobserved time-invariant specific effects; δ_t captures a common deterministic trend; and ϵ_{it} is a random disturbance (assumed to be normal), and identically distributed with $E(\epsilon_{it}) = 0$; $Var(\epsilon_{it}) = \sigma^2 > 0$.

4.2 Empirical Results

Summary statistics for each variable used in the panel data estimations are presented in Appendix Table A10. The dispersion around the mean is higher for the GFII, the DFIF, and per capita gross national income for women. This implies a less symmetrical distribution for these variables. However, as the coefficient of variation is lowest for

female life expectancy at birth, it shows a more symmetric distribution than other variables.

Appendix Table A11 presents simple correlation coefficients for the regression variable. Results show that the correlation coefficient between female mean years of schooling and female life expectancy at birth is high (i.e., 0.77). Similarly, the correlation coefficient between the total fertility rate and life expectancy at birth for females is very high (i.e., -0.89). Young (2017) indicated that if the absolute value of the Pearson correlation coefficient is less than 0.8, collinearity is less likely to exist. Therefore, we estimate the variance inflation factors (VIFs) for independent variables and present them in Appendix Table A10. As the VIF values of a pooled OLS regression are below 10, we confirm that our regression results are free from multicollinearity. However, the correlation coefficients between the DFIF and independent variables such as female mean year of schooling (i.e., 0.73) and gross national income per capita for females (i.e., 0.87) are high. Therefore, there is a possibility that our regression models suffer from endogeneity due to variables that are not considered and that may be included within the residuals, and that are correlated with the dependent variable and one independent variable.³ To solve this problem, we estimate panel two-stage least squares (2SLS) regression analysis.

Table 7 reports the estimated results. As previously mentioned, the panel sample comprises 109 economies selected based on data availability. The period covered for analysis is 2011–2021. The significance values of the F-test and Breusch-Pagan Lagrange Multiplier (LM) test for model specification indicate that we must choose a fixed-effect (FE) or a random-effect (RE) model for the analysis over a pooled regression model. The Hausman tests are conducted to choose between the FE and RE models. Given the statistically significant chi-squared value for the regression model, the FE model is chosen for our analysis. The Wald test for heteroskedasticity (chi-squared) indicates the presence of heteroskedasticity. The feasible generalized least squares (FGLS) method is employed for estimation to correct it. It automatically considers the country-fixed effect but does not incorporate the time effect. The FGLS estimator is more efficient than ordinary least squares in the presence of heteroskedasticity, and serial and cross-sectional correlations (Bai, Choi, and Liao 2021).

We run the “*testparm*” STATA command after estimating a fixed-effect model with time dummies to test for a time-fixed effect. The statistically insignificant F-values of the time-fixed effect reject the null that the coefficients for all years are jointly equal to zero, and hence, no time-fixed effects are needed in this case. The values of Wald chi-squared in the regression model indicate that overall, the regression model exhibits a statistically significant relationship between dependent and independent variables.

However, as we discussed earlier, our regression model may have suffered an endogeneity problem due to a higher correlation between explanatory variables and the error term. Therefore, we utilize an instrumental variable (IV) approach in a 2-SLS regression model. As the IV heteroskedasticity test, the Pagan-Hall general test statistic, is statistically significant at the 1% level, we use the *robust* option with the *ivreg2* STATA command to obtain robust standard errors. As per the estimated correlation coefficient values, female mean years of schooling and female per capita income can be endogenous variables when we consider the DFIF as the dependent variable. However, this is not the case for the GFII where correlation coefficients for these variables are small and endogeneity is not a problem; hence, we are not using

³ <https://www.statalist.org/forums/forum/general-stata-discussion/general/1347369-a-high-correlation-coefficient-between-the-dependent-variable-and-a-control-variable>.

an IV regression for the GFII. Thus, for the DFIF-based regression we utilize the IV-2SLS model. The IV-2SLS regression model considers total per capita gross domestic product as an instrument for female per capita income. With the limited data availability, we could consider only one instrument for female per capita income. On the other hand, female mean years of schooling is instrumented by female secondary education level.

The estimated results are presented in Table 7. The statistically significant χ^2 value of the endogeneity test indicates that per capita female national income and female mean years of schooling are endogenous variables. The statistically significant LM statistic of the Kleibergen-Paap test indicates that our model is not underidentified. Kleibergen-Paap and Cragg-Donald's statistics are greater than the Stock and Yogo 10% critical values. Therefore, we also reject the weakness of instruments. As we are using only one instrument, an overidentification test is not performed. However, as we have two endogenous variables, we consider two separate regression models by considering one of them in each model. We discuss below our regression results.

Table 7: Determinants of GFII and DFIF

| Variables | Dependent Variable | | | |
|--|---------------------------|---------------------------|-------------------------|---------------------------|
| | GFII | DFIF | DFIF | |
| | | | IV-2SLS | |
| | FGLS | | Model 3 | Model 4 |
| | Model 1 | Model 2 | Model 3 | Model 4 |
| Female life expectancy at birth (leb_f)(years) | -0.0189 (0.0165) | 0.00460 (0.00526) | 0.0706*** (0.0156) | -0.00195 (0.0131) |
| Female mean years of schooling (mys_f)(years) | 0.149*** (0.0202) | 0.0623*** (0.00800) | 0.113*** (0.0228) | |
| Gross national income per capita for females (gnp_f)(2011 PPP \$) | 6.85e-05*** (4.99e-06) | 5.93e-05*** (2.24e-06) | | 7.96e-05*** (6.68e-06) |
| Share of seats in parliament for females (parliament_f)(% held by women) | 0.0248*** (0.00538) | 0.00180 (0.00111) | 0.0138*** (0.00444) | -0.00124 (0.00343) |
| Labor force participation rate for females (lpr_f)(% ages 15 and older) | 0.0165*** (0.00415) | 0.00568*** (0.000998) | 0.0179*** (0.00296) | 0.00278 (0.00275) |
| Total fertility rate (tfr)(birth per women) | 0.0666 (0.0927) | 0.0195 (0.0219) | 0.202*** (0.0692) | -0.0240 (0.0610) |
| Percentage of urbanization (urban) | -0.0148*** (0.00366) | -0.00175 (0.00117) | 0.00677** (0.00274) | -0.00225 (0.00211) |
| Number of commercial bank branches per 100,000 adults (bank_bran) | -0.00711** (0.00291) | 0.00723*** (0.00157) | 0.00591* (0.00335) | 0.00745** (0.00376) |
| Number of ATMs per 100,000 adults (atm) | 0.0110*** (0.000979) | 0.00677*** (0.000503) | 0.00769*** (0.00109) | 0.00560*** (0.00109) |
| Constant | -2.174 (1.401) | -2.611*** (0.423) | -9.068*** (1.295) | -1.438 (1.159) |
| Wald χ^2/R^2 | 1,910.74*** | 12,044.00*** | 0.732 | 0.809 |
| Observations/number of economies | 296/104 | 296/104 | 296 | 296 |
| Endogeneity test (χ^2) | | | 3.237* | 46.921*** |
| Underidentification test (Kleibergen-Paap rk LM statistic): | | | 103.834*** | 67.940*** |
| Weak identification test | | | 1,446.442 | 790.529 |
| Cragg-Donald Wald F statistic | | | 2,260.655 | 300.146 |
| Kleibergen-Paap rk Wald F statistic | | | | |
| Stock-Yogo weak ID test critical values | | 10% maximal IV size | | 16.38 |
| | | 15% maximal IV size | | 8.96 |
| | | 20% maximal IV size | | 6.66 |
| | | 25% maximal IV size | | 5.53 |

Standard errors for FGLS and robust standard errors for IV-2SLS in parentheses.

*** p<0.01, ** p<0.05, * p<0.1.

4.3 Discussions

Our regression results show that gross national income per capita for females has a positive impact on both the GFII and the DFIF in regression models 1 and 2, respectively, revealing that economic condition matters. Secondly, the mean years of schooling for women and per capita gross national income have statistically significant impacts on women's overall financial inclusion, i.e., the GFII and the digital FI index (DFIF). The importance of education for financial inclusion has been reiterated by other studies as well (see Demirgüç-Kunt, Kane, and Laeven 2014), which observed that women are often found to be excluded from the financial system owing to a lack of education. However, interestingly, it is revealed that while improving these basic development variables is necessary for ensuring FI, other aspects of gender development also significantly contribute towards the FI of women. These include shares of seats in parliament for females and the female labor force participation rate. Needless to say, participation in the labor force and state institutions empowers a woman, and this lack of empowerment has been noted as a driving factor for several negative effects on women in the literature, including financial inclusion (Stewart and Samman 2014). Another study concerning Bangladesh (Pitt, Khandker, and Cartwright 2006) found that women empowered in terms of making fertility decisions have greater access to credit (an important component of financial inclusion).

As women's movements are often restricted, and women spend a considerable amount of time on household activities, the availability of proximal financial infrastructure makes a difference. It can be seen that the number of commercial bank branches per 100,000 adults (only for the DFIF) and the number of ATMs per 100,000 adults have a positive and statistically significant effect on female financial inclusions. In an aggregate study (considering both men and women), ATM and bank branch density were found to be closely related to an index of financial inclusion from the demand side (Delechat et al. 2018). In a country-specific study, the distance to bank branches was also found to enhance women's financial inclusion in Peru, and this effect was more pronounced than for men's financial inclusion (Bermeo 2019). However, in the present study, when we focus on women, the number of ATMs has a more positive impact than the bank branches (Table 7). This finding suggests women are moving more toward digital services. Further, as far as the DFIF indicator is concerned, the bank branch variable is not statistically significant, implying that digital services like those provided through ATMs matter the most. This finding is of importance for women, especially those living in rural and remote areas as bricks-and-mortar infrastructure no longer matters in the usage of financial services. Digitization has been observed to help with financial inclusion in other studies as well (Amidžić, Massara, and Mialou 2014; Gammage et al. 2017; World Bank 2020; Chen et al. 2021). Yeyouomo, Asongu, and Agyemang-Mintah (2023) take more fintech-related variables, including electricity availability, to show how it reduces the gender gap in financial inclusion. But this study is done for the African region only.

Interestingly, the percentage of urbanization has a negative effect on the GFII. A reason for this could be that the poor and the deprived themselves develop an aversion to banking in urban regions (Bertrand, Mullainathan, and Shafir 2006). For instance, one of our earlier field surveys in India that examined urban financial exclusion observed that the poor and uneducated, primarily self-employed women who have bank accounts, develop an aversion to banking. They feel they may not be valued as customers due to the smaller transactions required by them (Rajeev and Vani 2017). More importantly, they are often overwhelmed by relatively well-to-do and sophisticated customers, who account for a large proportion of the deposits in an urban bank.

Other indicators revealing the well-being of women such as life expectancy at birth, albeit not significant for the GFII, are positively significant for the digital index in regression 3. Further, economies that have women with higher fertility rates also indicate their higher level of engagement with household responsibilities, which makes them more dependent on digital services (coefficient is positively significant for the DFIF). Another cross-economy study corroborated the finding that life expectancy increased financial inclusion, possibly through more awareness of, and greater demand for, insurance products for access to better healthcare and longer lives (Datta and Singh 2019). While, in this study, the overall index was not affected by this variable, the digital index was, possibly indicating the move towards digital insurance products.

Concentrating further on the digital financial services, our results indicate that female mean years of schooling has a positive and statistically significant (at the 1% level) effect on the DFIF and the GFII. The coefficient of 0.11 in regression model 3 indicates that a 10% increase in female mean years of schooling increases women's financial inclusion (as measured by the GFII) by 1.1%. Also, with the penetration of digital technology, it appears that women who are in the labor force are also able to use financial services. These are promising trends for the support of fintech services. The results are consistent with the estimated results obtained from FGLS models.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This paper measures financial inclusion for women at the cross-economy level for 2011, 2014, 2017, and 2021 by using the World Bank's Global Findex database. A gender-based FI measure (GFII) based on the digital financial service usage index (DFI) and conventional financial service usage index (CFI) has been constructed for this purpose by employing principal component analysis. Eight indicators were identified to be incorporated, namely credit card ownership, debit card ownership, owning a mobile money account, borrowing any money from a formal financial institution or using a mobile money account, making or receiving a digital payment, owning a financial institution account, saving at a financial institution, and borrowing from a formal financial institution. To check the strength of our calculated index, we estimated the correlation between the GFII and the existing measures of gender development or deprivation, namely the GDI and the GII, and the constructed indices were found to be adequately correlated. Our analysis further reveals the names of economies that are progressing and the economies that are regressing in terms of financial inclusion. Finally, the determinants of the GFII have been identified using a static panel data model.

The estimated values of the GFII show that developed economies such as Canada; Hong Kong China; the United States; Australia; New Zealand; Israel; the United Kingdom; and Germany are ranked high in terms of inclusion of women in the financial system in 2021. On the other hand, developing economies such as Ecuador, Afghanistan, Pakistan, Iraq, Lebanon, Guinea, and Tanzania are ranked very low. Among the high-income economies, Italy; Uruguay; Chile; Hong Kong, China; and Japan show greater progress in the financial inclusion of women. In contrast, Saudi Arabia, Sweden, Slovenia, the Netherlands, Croatia, and the United Arab Emirates show slow progress from 2011 to 2021. During the same period, Bosnia and Herzegovina, Italy, Kazakhstan, Venezuela, Mali, Tajikistan, Uruguay, and India show the most remarkable improvement among all economies included in the analysis. Costa Rica, Ecuador, Zimbabwe, Tanzania, and Saudi Arabia show the lowest achievement in a similar comparison.

A strong negative correlation was observed between the GFII and the GII (-0.85), which shows that higher gender inequality is associated with lower financial inclusion for women. Similarly, the observed positive association between the GFII and the GDI indicates that a higher realization in the basic dimensions of human development for females shows an association with higher financial inclusion for women.

Significantly, the results show that the GII components have more compatible relations than the GDI components with women's financial inclusion. We observe that similar levels of GDI values of economies are associated with significantly different levels of financial inclusion for women. This indicates that women's empowerment in terms of political and labor market participation and higher education levels make a significant difference in achieving women's financial inclusion.

Among the economies that are better placed in terms of gender inequality ($GII \leq 0.1$), it can be seen that there is considerable variation in terms of achievements in the digital sphere of financial inclusion. While Canada (DFIF = 4.22), Japan (DFIF = 3.22), and New Zealand (DFIF = 3.21) had very high levels of digital financial inclusion among women, others such as Portugal (DFIF = 1.12), Croatia (DFIF = 1.07), and the United Arab Emirates (DFIF = 0.55) still have a lot of ground to cover in improving the reach of digital financial services. Although these economies have made strides in removing inequality for women in certain areas, it is clear that they need to focus also on empowering women through digital financial inclusion. On the other hand, economies that have high levels of gender inequality ($GII \geq 0.5$) all have similarly low levels of digital financial inclusion for women. Typically, the digital financial inclusion index for these economies ranges between -1 and -2 . Significant variations in digital FI for women can, however, also be observed among average-performing economies. For example, Thailand and Ecuador have similar GII values (0.333 and 0.362), but Thailand's DFIF is 0.32 while Ecuador falls far behind with a DFIF of -2.27 . Perhaps when improving the status of women on the path of development, policymakers in different economies pay markedly different levels of attention to the role of digital financial services, even though this is a powerful tool for empowering women and improving their economic participation and conditions. There exists the potential for economies at similar stages of development to learn from each other in this regard.

Finally, the estimated feasible generalized least squares (FGLS) and IV-2SLS panel data models indicate that female life expectancy at birth, mean years of schooling for females, gross national income per capita for females, the share of seats in parliament for females, the female labor force participation rate, the number of commercial bank branches per 100,000 adults, and the number of ATMs per 100,000 adults are important factors for improving female financial inclusion.

As far as policies are concerned, we suggest that low- and lower-middle-income economies must take prioritized measures to make their financial system more inclusive for women. Programs should be put in place to enhance the financial literacy of women for the usage of the internet, credit cards, mobile phones for digital payment, and Internet-based access to financial institutions. Recent data show that 48% of women use the internet globally, compared to 58% of men.⁴ This scenario is markedly different for developed economies as compared to developing economies.

Interestingly, economies that belong to the high- or upper-middle-income group but still have a relatively lower GFII include Saudi Arabia, the United Arab Emirates, Lithuania, Denmark, Costa Rica, Ecuador, Kosovo, Mauritius, and the Dominican Republic. Given that the GII is closely related to women's financial inclusion, it is necessary to note

⁴ <https://itu.foleon.com/itu/measuring-digital-development/gender-gap/> (retrieved on 7 January 2022).

women's higher level of education and political and labor market participation in these economies.

Our study suggests that India is one of the economies progressing towards a higher level of financial inclusion for women. The Pradhan Mantri Jan Dhan Yojana is a massive financial inclusion program in India that was introduced by the government on 15 August 2014. Under this scheme, 15 million bank accounts were opened on the inauguration day. Such a dedicated program is undoubtedly responsible for India's success in ensuring higher financial inclusion for women. It can be a lesson for other developing economies such as Zimbabwe, Tanzania, Zambia, and the Philippines that are not progressing well, to ensure better financial inclusion for women. Our study identifies economies that need attention in this respect by highlighting their past and current position in terms of the GFII. We also found that economies like Thailand, Sri Lanka, India, South Africa, and Malaysia rank better in the CFI but lower in the DFI for females. Given the mobility restrictions women face, these economies may pay attention to the digital financial inclusion of women, which is on a par with their performance in conventional mode-based inclusion.

Today, the world is moving towards the dominance of digital technologies in financial services. In particular, after the COVID-19 pandemic, a large increase in digital payments spurred financial inclusion. It is evidenced that the use of conventional financial factors is now suppressed by the use of digital financial factors. For example, the use of a "female financial institution account" increased by about 5% from 2017 to 2021. At the same time, the indicator "borrowed any money from a formal financial institution or using a mobile money account for females" increased by about 25% compared to 29% for males during the same period. This expansion opened up new economic opportunities, reduced the gender disparity in account ownership, and strengthened household resilience to better handle financial shocks.⁵ Therefore, to boost the financial inclusion of women, greater efforts should be aimed at enhancing access to digital financial services, digital education, and so on.

Finally, our analysis suggests that to enhance financial inclusion for women, a holistic gender development approach that includes higher educational attainment, per capita income, labor force participation, and political participation is essential. A better financial infrastructure in terms of a higher number of bank branches and more importantly better availability of ATMs further aids women to access financial services.

⁵ <https://www.worldbank.org/en/news/press-release/2022/06/29/covid-19-drives-global-surge-in-use-of-digital-payments>.

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APPENDIX

Appendix Table A1: Approaches towards Constructing a Financial Inclusion Index

| Author | Study Area | Variables | Data Source | Methodology | Conclusions |
|--|----------------------|---|---|---|--|
| General | | | | | |
| Sarma (2008) | Cross-country | Banking penetration: no. of bank A/Cs (per 1,000 adults); availability of banking services: no. of bank branches (per 100,000 adults); usage of the banking system: domestic credit (as % of GDP), domestic deposit (as % of GDP). | World Development Indicators (World Bank); International Financial Statistics (IMF) | The dimension index; index of financial inclusion is measured by the normalized inverse Euclidean distance of the point Di from the ideal | Proposed an index of financial inclusion (IFI): a comprehensive measure that can be used to measure the extent of financial inclusion across economies. |
| Chakravarty and Pal (2013) | Cross-country, India | Geographic branch penetration: number of bank branches per 1,000 sqkm; demographic branch penetration: number of bank branches per 100,000 people; geographic ATM penetration: number of bank ATMs per 1,000 sqkm; demographic ATM penetration: number of bank ATMs per 100,000 people; credit accounts per capita: number of loans per 1,000 people; credit-income ratio: the average size of loans to GDP per capita; deposit accounts per capita: number of deposits per 1,000 people; deposit-income ratio: the average size of deposits to GDP per capita. | Beck, Demirguc-Kunt, and Levine (2007) | It presents an analysis of banking financial inclusion using an axiomatic approach. | The suggested index of financial inclusion allows the calculation of percentage contributions of different dimensions to the overall achievement. The study made a cross-country comparison of financial inclusion as well as analyzing financial inclusion across subnational regions of India. |
| Sarma (2012) | Cross-country | No. of bank accounts per 1,000 adults; no. of bank branches per 100,000 adults; no. of ATMs per 100,000 adults; loans +deposits (as a percentage of GDP). | Financial Access Survey (FAS) database of the International Monetary Fund (IMF) The World Bank | Index of Financial Inclusion based on normalized Euclidean distance based on Euclidean distance. | The proposed index is easy to compute and is comparable across countries and over time. It also satisfies some important mathematical properties. |
| Gupte, Venkataramani, and Gupta (2012) | Cross-country | Outreach: the number of bank branches and ATMs per 1,000 km ² ; the number of bank branches and ATMs per 100,000 people; the number of accounts per 1,000 adults (deposits and loans); usage: volume of deposits and loans as % of GDP; ease of transactions and cost of transactions: annual fees charged to customers for ATM cards; accounts and the cost of international transfer of money. | | Financial inclusion index based on maximum and minimum values. | This paper aims to study the determinants that measure the extent of financial inclusion and focuses on computing an index that would comprehensively capture the impact of multidimensional variables with specific reference to India, using the latest available data. |

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Appendix Table A1 continued

| Author | Study Area | Variables | Data Source | Methodology | Conclusions |
|-------------------------------------|---------------|---|---|--|--|
| Sarma (2015, 2016) | Cross-country | Banking penetration: number of deposit bank accounts per 1,000 adults; availability: the number of bank branches and ATMs per 100,000 adults (using 2/3 weight for bank branch index and 1/3 for ATM index); usage: the volume of credit and deposit to adult individuals as a proportion of GDP. | Financial Access Survey (FAS) database of IMF | Similarly to Sarma (2008), there is more improvement than using the distance from the lowest point (0,0,0) to the ideal point (1, 0.5, 0.5). | The proposed index of financial inclusion (IFI) is easy to compute and measure financial inclusion at different time points and different levels of economic aggregation (village, province, state, nation, and so on). It is also suggested that even "well-developed" financial systems have not succeeded in being "all-inclusive," and certain segments of the population remain outside the formal financial systems. |
| Cámara and Tuesta (2017) | | Usage: account, savings and loans; barriers: distance, affordability, documentation, lack of trust; access: number of ATMs and bank branches per 1,000 km ² ; the number of ATMs and bank branches per 100,000 people. | World Bank's Global Findex (2011) | Compute FI index by employing a two-stage PCA method. | Their composite index offers a comprehensive measure of the degree of financial inclusion, easy to understand and compute. |
| Mialou, Amidžić, and Massara (2017) | Cross-country | Outreach of financial services: number of ATMs and branches per 1,000 km ² ; use of financial services: number of household borrowers and depositors per 1,000 adults. | IMF | The composite index uses factor analysis (FA) to derive a weighting methodology. | Countries are then ranked based on the new composite index, providing an additional analytical tool that could be used for surveillance and policy purposes on a regular basis. |
| Bansal (2014) | India | Accounts at a formal financial institution in rural and urban area; value-wise share of paper-based and electronic transaction. | IMF | Descriptive statistics. | Studied the contribution of ICT towards financial inclusion in the country and analyzed the different applications of ICT that banks are adopting. |
| Park and Mercado (2018a) | Cross-country | ATMs per 100,000 adults; commercial bank branches per 100,000 adults; borrowers from commercial banks per 1,000 adults; depositors with commercial banks per 1,000 adults; domestic credit to GDP ratio. | IMF | Calculate the FI index as the method of Sarma (2008). | The estimation results show that per capita income, rule of law, and demographic characteristics significantly affect financial inclusion for both world and Asia samples. |
| Park and Mercado (2018b) | Cross-country | Access dimension: the percentage share of adults with an account; availability dimension: number of bank branches and ATMs per 100,000 adults; usage dimension: the share of adults who borrowed and saved from a financial institution; the domestic credit-to-GDP ratio. | IMF | Combine the approaches of Sarma (2016) and Cámara and Tuesta (2014) | The results provide evidence that high- and middle-high-income economies with high financial inclusion have significantly lower poverty, while no such relation exists for middle-low- and low-income economies. |
| Chatterjee and Das (2021) | India | Credit and deposit amount as a proportion of GSDP; number of bank accounts per 1,000 population; number of bank offices per lakh population; tele-density; number of internet subscribers per 100 population; mobile phones per 100 population. | Indiastat.com | Financial Inclusion Index (FI) based on Sharma (2012); Information Technology Index | The results show that technology does play an important role in improving financial inclusion. |

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Appendix Table A1 continued

| Author | Study Area | Variables | Data Source | Methodology | Conclusions |
|-------------------------------|---------------|--|---|---|--|
| Bhurat (2019) | BRICS | Access to a mobile phone (% age 15+); access to a mobile phone: male-female (% age 15+); access to a mobile phone: income disparity; account and active account (% age 15+); account, male-female (% age 15+); account: income disparity; ATMs and branches per 100,000 adults; made or received digital payments in the past year (% age 15+); borrowed from a financial institution or used a credit card (% age 15+); used a debit or credit card to make a purchase in the past year (% age 15+); access to a mobile phone, access to Internet and payments made by using mobile phone or Internet (%15+); saved at a financial institution (% age 15+). | World Bank and Global Findex database | Descriptive statistics | The paper aims to examine the concept of financial inclusion and its relevance with respect to the world's emerging economies: Brazil, the Russian Federation, India, the PRC, and South Africa (BRICS). |
| Ahamed and Mallick (2019) | Cross-country | Financial outreach: demographics (the number of bank branches and ATMs/100,000 people), geographic (the number of bank branches and ATMs per 1,000 km ²); usage: number of bank accounts per 1,000 population. | World Bank | Build a multidimensional index by using PCA method | A higher level of financial inclusion contributes to greater bank stability. |
| Fanta and Makina (2019) | Cross-country | Fixed telephone; mobile subscriptions; ATMs; Internet access. | World Development Indicators | Descriptive statistics and regression analysis | There is evidence that technology fosters both access to, and usage of, financial services. |
| Van et al. (2021) | Cross-country | The number of commercial bank branches per 100,000 adults; the number of ATMs per 100,000 adults; the ratio of bank credit for the private sector to GDP. | Global Findex database and World Development Indicators | Index of Financial Inclusion(IFI) based on Sarma (2008) | The finding supports a positive relationship between financial inclusion and economic growth. |
| Nagpal, Jain, and Jain (2020) | BRICS | Formal saving; formal credit; formal account. | Global Findex Database 2017 | Probit regression | The findings suggest that Internet usage and mobile penetration rates have a positive association with financial inclusion indicators in BRICS economies. |
| Tram, Lai, and Nguyen (2021) | Cross-country | The penetration dimension (the number of deposit accounts with commercial banks; credit unions; mobile money accounts (mobile money accounts)); the availability dimension (the number of branches and ATMs per 100,000 adults; mobile money agent outlets per 100,000 adults (mobile money agents)); the usage dimension (outstanding deposits (% of GDP); outstanding loans (% of GDP); the value of mobile money transactions (% of GDP) (mobile money transactions)). | The World Bank (WB) and International Monetary Fund (IMF) | A measure of financial inclusion is constructed using a two-stage principal component analysis (PCA) method by assigning weights endogenously | A new detailed index of financial inclusion measurement termed " overall FI index" was built based on the study. |

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Appendix Table A1 continued

| Author | Study Area | Variables | Data Source | Methodology | Conclusions |
|---|------------------------|---|--|-------------------------------------|---|
| Female financial inclusion index | | | | | |
| Asongu and Odhiambo (2018) | 48 countries in Africa | Mobile phone penetration; Internet penetration; fixed broadband subscriptions; remittances; financial system deposits; financial credit; political stability; female economic participation – female labor force participation; financial stability (likelihood that bank might survive and not go bankrupt). | The World Bank, International Labour organization | Generalized Method of Moments | The study supports the importance of ICT in moderating financial access for enhanced female economic participation. |
| Morsy (2020) | Cross-country | Banking system ownership: state-owned or foreign-owned bank; depth of credit information index (CII); strength of legal rights index (LR); women' s rate of participation in the labor market; educational attainment subindex; inequality in income; financial depth; access to property; ratio: financial inclusion(FINDEX) account; Herfindahl-Hirschman Index for measuring banking concentration; financial inclusion – account (female/male); account for business purpose(female/male); savings (female/male); credit card (female/male); debit card (female/male); loan (female/male); wages (female/male). | Bankscope database, Global Findex database, 2017, The World Bank, World Economic Forum (WEF) database, United Nations Inequality-adjusted Human Development Index, Gender, Institutions and Development Database | A fixed-effects model, Hausman test | Suggest that women are more likely to be excluded from the financial sector in countries where: (i) foreign-owned banks have a smaller presence; (ii) state-owned banks have a bigger share in the banking system; (iii) credit information is less available through public and private credit registries; (iv) gaps between women and men in educational attainment are large. The results are robust to different specifications and alternative measures of financial inclusion. |
| Delechat et al. (2018) | Cross-country | Education, at least secondary; age; wage employed; population density; log of real GDP per capita; fertility rate; financial development; women' s mean age at marriage; mean years of schooling; ICRG risk rating (composite index and political risk index); legislation against domestic violence (average); and civil remedies for sexual harassment); social discrimination against women (SIGI); Corruption Perception Index; Legal Rights Index; financial inclusion: having an account | The World Bank, Index IMF, Penn World, UNPD World Fertility and Marriage Database, Barro and Lee (2013), International Country Risk Guide, Women Business and the Law, Social Institutions and Gender Index, Transparency International, Findex. | Ordinary least squares | 1. Structural country characteristics, such as resource richness and level of development, and policies, such as stronger institutions, and financial development are significantly related to financial inclusion. 2. A robust negative relationship between being female and financial inclusion as in previous studies, and our analysis points to legal discrimination, a lack of protection from harassment, including at the workplace, and more diffuse gender norms as possible explanatory factors. |

Source: Synthesized by authors from the review of relevant studies in the area.

Appendix Table A2: KMO and Bartlett' s Test

| Test for validity of the data | Estimated values | | | | | | | | | | | |
|----------------------------------|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 2011 | | | 2014 | | | 2017 | | | 2021 | | |
| | DFI | CFI | FII | DFI | CFI | FII | DFI | CFI | FII | DFI | CFI | FII |
| <i>Male</i> | | | | | | | | | | | | |
| KMO measure of sampling adequacy | 0.500 | 0.663 | 0.500 | 0.568 | 0.768 | 0.50 | 0.762 | 0.566 | 0.50 | 0.645 | 0.761 | 0.50 |
| Bartlett' s test of sphericity | 91.17 | 155.1 | 141 | 434 | 258.0 | 262 | 266.4 | 387.1 | 272.3 | 634.2 | 243.1 | 341.8 |
| Df | 1 | 3 | 1 | 6 | 3 | 1 | 3 | 6 | 1 | 10 | 3 | 1 |
| Sig. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0.0 |
| <i>Female</i> | | | | | | | | | | | | |
| KMO measure of sampling adequacy | 0.500 | 0.617 | 0.500 | 0.569 | 0.759 | 0.50 | 0.566 | 0.573 | 0.50 | 0.631 | 0.749 | 0.50 |
| Bartlett' s test of sphericity | 75.21 | 162.1 | 159 | 414 | 246 | 268 | 387 | 395 | 278 | 635 | 236 | 331 |
| Df | 1 | 3 | 1 | 6 | 3 | 1 | 6 | 6 | 1 | 10 | 3 | 1 |
| Sig. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 | 0.00 | 0.000 | 0.0 |

Note: KMO = Kaiser-Meyer-Olkin.
Source: Authors' calculation.

**Appendix Table A3: Principal Component Estimates
for Different Financial Indices for 2011**

| Male | | | | |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| Component | Eigenvalue | Difference | Proportion | Cumulative |
| <i>DFI</i> | | | | |
| Comp1 | 1.7584 | 1.51681 | 0.8792 | 0.8792 |
| Comp2 | 0.241597 | . | 0.1208 | 1 |
| <i>CFI</i> | | | | |
| Comp1 | 2.26817 | 1.72441 | 0.7561 | 0.7561 |
| Comp2 | 0.543762 | 0.355691 | 0.1813 | 0.9373 |
| Comp3 | 0.188071 | . | 0.0627 | 1 |
| <i>FII</i> | | | | |
| Comp1 | 1.85696 | 1.71391 | 0.9285 | 0.9285 |
| Comp2 | 0.143043 | . | 0.0715 | 1 |
| Female | | | | |
| Component | Eigenvalue | Difference | Proportion | Cumulative |
| <i>DFI</i> | | | | |
| Comp1 | 1.7117 | 1.4234 | 0.8558 | 0.8558 |
| Comp2 | 0.288301 | . | 0.1442 | 1 |
| <i>CFI</i> | | | | |
| Comp1 | 2.19285 | 1.53649 | 0.731 | 0.731 |
| Comp2 | 0.656356 | 0.505563 | 0.2188 | 0.9497 |
| Comp3 | 0.150794 | . | 0.0503 | 1 |
| <i>FII</i> | | | | |
| Comp1 | 1.88102 | 1.76204 | 0.9405 | 0.9405 |
| Comp2 | 0.11898 | . | 0.0595 | 1 |

Source: Calculated by the authors.

**Appendix Table A4: Principal Component Estimates
for Different Financial Indices for 2014**

| Male | | | | |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| Component | Eigenvalue | Difference | Proportion | Cumulative |
| <i>DFI</i> | | | | |
| Comp1 | 2.80433 | 1.8529 | 0.7011 | 0.7011 |
| Comp2 | 0.951438 | 0.735969 | 0.2379 | 0.9389 |
| Comp3 | 0.21547 | 0.186712 | 0.0539 | 0.9928 |
| Comp4 | 0.028758 | . | 0.0072 | 1 |
| Comp5 | | | | |
| <i>CFI</i> | | | | |
| Comp1 | 2.6344 | 2.44863 | 0.8781 | 0.8781 |
| Comp2 | 0.185762 | 0.005921 | 0.0619 | 0.9401 |
| Comp3 | 0.179841 | . | 0.0599 | 1 |
| <i>FII</i> | | | | |
| Comp1 | 1.95651 | 1.91303 | 0.9783 | 0.9783 |
| Comp2 | 0.043487 | . | 0.0217 | 1 |
| Female | | | | |
| Component | Eigenvalue | Difference | Proportion | Cumulative |
| <i>DFI</i> | | | | |
| Comp1 | 2.75449 | 1.78801 | 0.6886 | 0.6886 |
| Comp2 | 0.966487 | 0.717478 | 0.2416 | 0.9302 |
| Comp3 | 0.24901 | 0.219 | 0.0623 | 0.9925 |
| Comp4 | 0.03001 | . | 0.0075 | 1 |
| Comp5 | | | | |
| <i>CFI</i> | | | | |
| Comp1 | 2.60549 | 2.37767 | 0.8685 | 0.8685 |
| Comp2 | 0.227817 | 0.061122 | 0.0759 | 0.9444 |
| Comp3 | 0.166695 | . | 0.0556 | 1 |
| <i>FII</i> | | | | |
| Comp1 | 1.95869 | 1.91738 | 0.9793 | 0.9793 |
| Comp2 | 0.04131 | . | 0.0207 | 1 |

Source: Calculated by the authors.

**Appendix Table A5: Principal Component Estimates
for Different Financial Indices for 2017**

| Male | | | | |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| Component | Eigenvalue | Difference | Proportion | Cumulative |
| <i>DFI</i> | | | | |
| Comp1 | 2.84201 | 1.95539 | 0.7105 | 0.7105 |
| Comp2 | 0.886618 | 0.660532 | 0.2217 | 0.9322 |
| Comp3 | 0.226086 | 0.180797 | 0.0565 | 0.9887 |
| Comp4 | 0.045289 | . | 0.0113 | 1 |
| <i>CFI</i> | | | | |
| Comp1 | 2.64445 | 2.43724 | 0.8815 | 0.8815 |
| Comp2 | 0.207215 | 0.058886 | 0.0691 | 0.9506 |
| Comp3 | 0.14833 | . | 0.0494 | 1 |
| <i>FII</i> | | | | |
| Comp1 | 1.96046 | 1.92091 | 0.9802 | 0.9802 |
| Comp2 | 0.039543 | . | 0.0198 | 1 |
| Female | | | | |
| Component | Eigenvalue | Difference | Proportion | Cumulative |
| <i>DFI</i> | | | | |
| Comp1 | 2.80118 | 1.89111 | 0.7003 | 0.7003 |
| Comp2 | 0.910064 | 0.658629 | 0.2275 | 0.9278 |
| Comp3 | 0.251435 | 0.214111 | 0.0629 | 0.9907 |
| Comp4 | 0.037324 | . | 0.0093 | 1 |
| <i>CFI</i> | | | | |
| Comp1 | 2.63794 | 2.40313 | 0.8793 | 0.8793 |
| Comp2 | 0.23481 | 0.10756 | 0.0783 | 0.9576 |
| Comp3 | 0.127251 | . | 0.0424 | 1 |
| <i>FII</i> | | | | |
| Comp1 | 1.9627 | 1.92541 | 0.9814 | 0.9814 |
| Comp2 | 0.037295 | . | 0.0186 | 1 |

Source: Calculated by the authors.

Appendix Table A6: Scoring Coefficients for Orthogonal Varimax Rotation (Weights) for 2011

| Variable | Male | | Female | |
|------------|--------|-------------|--------|-------------|
| | Comp1 | Unexplained | Comp1 | Unexplained |
| <i>DFI</i> | | | | |
| X1 | 0.7071 | 0.1208 | 0.7071 | 0.1442 |
| X2 | 0.7071 | 0.1208 | 0.7071 | 0.1442 |
| <i>CFI</i> | | | | |
| X6 | 0.6024 | 0.177 | 0.6256 | 0.1418 |
| X7 | 0.61 | 0.156 | 0.6203 | 0.1563 |
| X8 | 0.5148 | 0.3988 | 0.4732 | 0.5091 |
| <i>FII</i> | | | | |
| DFI | 0.7071 | 0.07152 | 0.7071 | 0.05949 |
| CFI | 0.7071 | 0.07152 | 0.7071 | 0.05949 |

Source: Calculated by the authors.

Appendix Table A7: Scoring Coefficients for Orthogonal Varimax Rotation (Weights) for 2014

| Variable | Male | | Female | |
|------------|---------|-------------|---------|-------------|
| | Comp1 | Unexplained | Comp1 | Unexplained |
| <i>DFI</i> | | | | |
| X1 | 0.5515 | 0.147 | 0.5492 | 0.1691 |
| X2 | 0.576 | 0.06952 | 0.5776 | 0.08111 |
| X4 | -0.1965 | 0.8917 | -0.1682 | 0.9221 |
| X5 | 0.5705 | 0.08742 | 0.5801 | 0.07317 |
| <i>CFI</i> | | | | |
| X6 | 0.5767 | 0.124 | 0.5773 | 0.1316 |
| X7 | 0.5777 | 0.1208 | 0.5837 | 0.1124 |
| X8 | 0.5777 | 0.1209 | 0.571 | 0.1505 |
| <i>FII</i> | | | | |
| DFI | 0.7071 | 0.02174 | 0.7071 | 0.02065 |
| CFI | 0.7071 | 0.02174 | 0.7071 | 0.02065 |

Source: Calculated by the authors.

Appendix Table A8: Scoring Coefficients for Orthogonal Varimax Rotation (Weights) for 2017

| Variable | Male | | Female | |
|------------|---------|-------------|---------|-------------|
| | Comp1 | Unexplained | Comp1 | Unexplained |
| <i>DFI</i> | | | | |
| X1 | 0.5452 | 0.1551 | 0.542 | 0.1772 |
| X2 | 0.5678 | 0.08371 | 0.5748 | 0.07436 |
| X4 | -0.2826 | 0.773 | -0.2511 | 0.8234 |
| X5 | 0.5481 | 0.1462 | 0.5592 | 0.1239 |
| <i>CFI</i> | | | | |
| X6 | 0.5717 | 0.1356 | 0.5694 | 0.1447 |
| X7 | 0.5836 | 0.09945 | 0.5895 | 0.08344 |
| X8 | 0.5767 | 0.1205 | 0.573 | 0.1339 |
| <i>FII</i> | | | | |
| DFI | 0.7071 | 0.01977 | 0.7071 | 0.01865 |
| CFI | 0.7071 | 0.01977 | 0.7071 | 0.01865 |

Source: Calculated by the authors.

Appendix Table A9: Ranking of Economies Based on GFII

| Srl. No. | Economy | Rank in 2011 | Rank in 2021 | Differences from 2011 to 2021 | Srl. No. | Economy | Rank in 2011 | Rank in 2021 | Differences from 2011 to 2021 |
|----------|------------------------|--------------|--------------|-------------------------------|----------|----------------------|--------------|--------------|-------------------------------|
| 1 | Afghanistan | 106 | 108 | -2 | 56 | Kosovo | 84 | 99 | -15 |
| 2 | Albania | 80 | 70 | 10 | 57 | Kyrgyz Republic | 86 | 72 | 14 |
| 3 | Algeria | 97 | 96 | 1 | 58 | Latvia | 27 | 34 | -7 |
| 4 | Argentina | 57 | 59 | -2 | 59 | Lebanon | 109 | 105 | 4 |
| 5 | Armenia | 66 | 71 | -5 | 60 | Lithuania | 33 | 45 | -12 |
| 6 | Australia | 4 | 4 | 0 | 61 | Malawi | 69 | 90 | -21 |
| 7 | Austria | 17 | 14 | 3 | 62 | Malaysia | 41 | 41 | 0 |
| 8 | Bangladesh | 63 | 79 | -16 | 63 | Mali | 104 | 78 | 26 |
| 9 | Belgium | 11 | 20 | -9 | 64 | Malta | 21 | 29 | -8 |
| 10 | Benin | 89 | 100 | -11 | 65 | Mauritius | 37 | 49 | -12 |
| 11 | Bolivia | 60 | 61 | -1 | 66 | Moldova | 77 | 58 | 19 |
| 12 | Bosnia and Herzegovina | 108 | 51 | 57 | 67 | Mongolia | 23 | 31 | -8 |
| 13 | Brazil | 44 | 44 | 0 | 68 | Nepal | 82 | 74 | 8 |
| 14 | Bulgaria | 51 | 37 | 14 | 69 | Netherlands | 12 | 25 | -13 |
| 15 | Burkina Faso | 94 | 98 | -4 | 70 | New Zealand | 2 | 5 | -3 |
| 16 | Cambodia | 75 | 66 | 9 | 71 | Nicaragua | 81 | 82 | -1 |
| 17 | Cameroon | 96 | 89 | 7 | 72 | Nigeria | 74 | 83 | -9 |
| 18 | Canada | 1 | 1 | 0 | 73 | North Macedonia | 45 | 54 | -9 |
| 19 | Chile | 58 | 39 | 19 | 74 | Pakistan | 105 | 107 | -2 |
| 20 | PRC | 39 | 24 | 15 | 75 | Panama | 68 | 75 | -7 |
| 21 | Colombia | 71 | 73 | -2 | 76 | Peru | 67 | 64 | 3 |
| 22 | Congo, Rep. | 99 | 91 | 8 | 77 | Philippines | 56 | 76 | -20 |
| 23 | Costa Rica | 40 | 88 | -48 | 78 | Poland | 38 | 33 | 5 |
| 24 | Croatia | 22 | 35 | -13 | 79 | Portugal | 36 | 36 | 0 |
| 25 | Cyprus | 25 | 32 | -7 | 80 | Romania | 62 | 60 | 2 |
| 26 | Czech Republic | 31 | 28 | 3 | 81 | Russian Federation | 54 | 38 | 16 |
| 27 | Denmark | 6 | 15 | -9 | 82 | Saudi Arabia | 26 | 48 | -22 |
| 28 | Dominican Republic | 53 | 65 | -12 | 83 | Senegal | 98 | 81 | 17 |
| 29 | Ecuador | 70 | 109 | -39 | 84 | Serbia | 48 | 46 | 2 |
| 30 | Egypt, Arab Rep. | 100 | 93 | 7 | 85 | Sierra Leone | 83 | 102 | -19 |
| 31 | El Salvador | 92 | 87 | 5 | 86 | Singapore | 28 | 23 | 5 |
| 32 | Estonia | 20 | 21 | -1 | 87 | Slovak Republic | 30 | 27 | 3 |
| 33 | Finland | 5 | 11 | -6 | 88 | Slovenia | 13 | 26 | -13 |
| 34 | France | 16 | 18 | -2 | 89 | South Africa | 59 | 53 | 6 |
| 35 | Gabon | 95 | 101 | -6 | 90 | Spain | 29 | 19 | 10 |
| 36 | Georgia | 61 | 57 | 4 | 91 | Sri Lanka | 42 | 52 | -10 |
| 37 | Germany | 15 | 8 | 7 | 92 | Sweden | 3 | 17 | -14 |
| 38 | Ghana | 76 | 84 | -8 | 93 | Taipei,China | 14 | 13 | 1 |
| 39 | Greece | 46 | 47 | -1 | 94 | Tajikistan | 102 | 77 | 25 |
| 40 | Guinea | 103 | 104 | -1 | 95 | Tanzania | 78 | 103 | -25 |
| 41 | Honduras | 87 | 92 | -5 | 96 | Thailand | 32 | 42 | -10 |
| 42 | Hong Kong, China | 18 | 2 | 16 | 97 | Togo | 93 | 86 | 7 |
| 43 | Hungary | 35 | 43 | -8 | 98 | Türkiye | 49 | 56 | -7 |
| 44 | India | 88 | 67 | 21 | 99 | Uganda | 79 | 68 | 11 |
| 45 | Indonesia | 72 | 62 | 10 | 100 | Ukraine | 55 | 40 | 15 |
| 46 | Iran, Islamic Rep. | 34 | 50 | -16 | 101 | United Arab Emirates | 43 | 55 | -12 |
| 47 | Iraq | 101 | 106 | -5 | 102 | United Kingdom | 8 | 7 | 1 |
| 48 | Ireland | 7 | 9 | -2 | 103 | United States | 10 | 3 | 7 |
| 49 | Israel | 19 | 6 | 13 | 104 | Uruguay | 52 | 30 | 22 |
| 50 | Italy | 47 | 16 | 31 | 105 | Uzbekistan | 85 | 80 | 5 |
| 51 | Japan | 24 | 10 | 14 | 106 | Venezuela, RB | 90 | 63 | 27 |
| 52 | Jordan | 91 | 97 | -6 | 107 | West Bank and Gaza | 107 | 95 | 12 |
| 53 | Kazakhstan | 50 | 22 | 28 | 108 | Zambia | 65 | 85 | -20 |
| 54 | Kenya | 73 | 69 | 4 | 109 | Zimbabwe | 64 | 94 | -30 |
| 55 | Korea, Rep. | 9 | 12 | -3 | | | | | |

Source: Calculated by authors.

Appendix Table A10: Descriptive Statistics for Panel Data

| Variable | Observation | Mean | Standard Deviation | Minimum | Maximum | Coefficient of Variation | VIF |
|--------------|-------------|-----------|--------------------|----------|-----------|--------------------------|------|
| GFII | 436 | -0.25965 | 6.046691 | -122.259 | 5.82302 | -2,328.81 | |
| DFIF | 436 | -4.37E-08 | 1.389814 | -2.0589 | 3.26171 | -3.2E+09 | |
| leb_f | 424 | 75.92555 | 7.92105 | 51.7907 | 88.3257 | 10.43265 | 8.8 |
| mys_f | 424 | 9.125808 | 3.33553 | 0.625671 | 14.00974 | 36.55052 | 3.04 |
| gnp_f | 424 | 16,077.04 | 14,433.36 | 506.14 | 75,093.99 | 89.77623 | 3.28 |
| parliament_f | 420 | 22.82223 | 10.82223 | 0 | 51.80723 | 47.41969 | 1.21 |
| lpr_f | 424 | 50.21887 | 14.52889 | 11.078 | 82.953 | 28.93114 | 1.41 |
| tfr | 324 | 2.531128 | 1.294565 | 1.052 | 6.545 | 51.14577 | 5.7 |
| urban | 428 | 63.23539 | 21.15469 | 15.672 | 100 | 33.45388 | 2.17 |
| bank_bran | 410 | 18.43251 | 14.50634 | 0.31303 | 88.42213 | 78.69975 | 1.51 |
| atm | 400 | 55.69822 | 48.7878 | 0.373619 | 281.2314 | 87.5931 | 2.01 |
| Mean VIF | | | | | | | 3.24 |

Note: See Table 7 for variable definitions.

Source: Authors' calculation.

Appendix Table A11: Correlation Coefficients

| | GFII | DFIF | leb_f | mys_f | gnp_f | parliament_f | lpr_f | tfr | urban | bank_bran | atm |
|--------------|-------|-------|-------|-------|-------|--------------|-------|-------|-------|-----------|------|
| GFII | 1.00 | | | | | | | | | | |
| DFIF | 0.23 | 1.00 | | | | | | | | | |
| leb_f | 0.11 | 0.72 | 1.00 | | | | | | | | |
| mys_f | 0.16 | 0.73 | 0.77 | 1.00 | | | | | | | |
| gnp_f | 0.20 | 0.87 | 0.72 | 0.69 | 1.00 | | | | | | |
| parliament_f | 0.15 | 0.27 | 0.18 | 0.12 | 0.33 | 1.00 | | | | | |
| lpr_f | 0.15 | 0.17 | -0.17 | -0.01 | 0.16 | 0.21 | 1.00 | | | | |
| tfr | -0.10 | -0.62 | -0.89 | -0.74 | -0.59 | -0.11 | 0.12 | 1.00 | | | |
| urban | 0.04 | 0.59 | 0.68 | 0.60 | 0.63 | 0.13 | -0.12 | -0.53 | 1.00 | | |
| bank_bran | 0.06 | 0.46 | 0.51 | 0.47 | 0.37 | 0.09 | -0.09 | -0.54 | 0.34 | 1.00 | |
| atm | 0.17 | 0.70 | 0.64 | 0.58 | 0.59 | 0.08 | 0.08 | -0.59 | 0.49 | 0.47 | 1.00 |

Note: See Table 7 for variable definitions. Calculation is based on 244 observations.

Source: Authors' calculation.