

Business & Society

Questioning the Efficiency of Fintech and Financial inclusion in Reducing the Gender Gap: an International Quantile Analysis

Journal:	<i>Business & Society</i>
Manuscript ID	BAS-25-0737
Manuscript Type:	Original Manuscript - Full Length
Keywords:	Gender inequality, Financial Inclusion, Fintech, Policymaking, sustainability
Abstract:	<p>Purpose This study investigates whether Fintech reduces gender inequality through active financial inclusion activities, such as i) Borrowing and ii) Saving; or whether pre-existing social constraints limit financial inclusion to only Access activity, iii) such as opening an Account.</p> <p>Design/methodology This study utilizes Quartile OLS regression analysis for a sample of 147 countries in 2011- 2021.</p> <p>Results Empirical results show that Fintech enhances the propensity of females to be financially included through Account ownership, Savings and Borrowing. However, a reduction in gender inequality is only realized to an Access form of financial inclusion (Account ownership), not Active forms which can enhance social mobility (Borrowing and Saving). Results are consistent when the sample is partitioned by time and country-level income, development stage, and when machine learning approaches are applied.</p> <p>Contribution To the best of our knowledge, this is the first study to identify that pre-existing social constraints associated with access to equity mitigate Fintech's effect in reducing gender inequality. The result speak to the action that is required to normalize Active financial inclusion opportunities amongst females to reduce the gender gap. As a result, the study contributes to international policymaking debates and extends the finance and sustainability literatures.</p>

Questioning the Efficiency of Fintech and Financial inclusion in Reducing the Gender Gap: an International Quantile Analysis

Abstract

Purpose

This study investigates whether Fintech reduces gender inequality through active financial inclusion activities, such as i) Borrowing and ii) Saving; or whether pre-existing social constraints limit financial inclusion to only Access activity, iii) such as opening an Account.

Design/methodology

This study utilizes Quartile OLS regression analysis for a sample of 147 countries in 2011- 2021.

Results

Empirical results show that Fintech enhances the propensity of females to be financially included through Account ownership, Savings and Borrowing. However, a reduction in gender inequality is only realized to an Access form of financial inclusion (Account ownership), not Active forms which can enhance social mobility (Borrowing and Saving). Results are consistent when the sample is partitioned by time and country-level income, development stage, and when machine learning approaches are applied.

Contribution

To the best of our knowledge, this is the first study to identify that pre-existing social constraints associated with access to equity mitigate Fintech’s effect in reducing gender inequality. The result speak to the action that is required to normalize Active financial inclusion opportunities amongst females to reduce the gender gap. As a result, the study contributes to international policymaking debates and extends the finance and sustainability literatures.

Keywords: Gender inequality; Financial Inclusion; Fintech; Policymaking; Sustainability

1. Introduction

Many argue that new technologies such as Fintech have the potential to reduce gender inequality. Song et al. (2024) argue that Fintech algorithms remove gender biases from the decision-making process of financial institutions. Loco & Yang (2022) assert that Fintech can reduce gender inequality, because it has the potential to remove some restrictions embedded in traditional financial services. In support of this view, Yeyouomo et al. (2023) note that Fintech may narrow the gender gap, by reducing disparities in both access and usage of financial services. On the other hand, critics argue that Fintech technology's effect in reducing gender inequality may be limited. Kömürçüoğlu & Kömürçüoğlu (2025) provide evidence that Fintech does not reduce gender inequality. Sparks & Eckenrode (2020) surmise that Fintech has the potential to narrow the class and rural divide, but has no significant impact on the gender gap. Taken together, different perspectives exist in the literature pertaining as to whether, or not, Fintech may reduce gender inequality. To address this academic tension, this study's primary research objective is to answer the following question. *Does Fintech reduce gender inequality, through financial inclusion (access/usage)?*

We have several motivations to conduct this study. First, Demir et al. (2022) argue that increasing financial inclusion/participation (Account access, Borrowing and Saving), has the potential to lead to lower levels of income inequality. Moreover, Kanga et al. (2021) argue that Fintech has the potential to enhance financial inclusion through technology diffusion (Kanga et al., 2021). However, many argue that there is no guarantee that financial inclusion will reduce income inequality (Kling et al. 2021; Lashitew et al., 2019; Tian & Kling, 2021). Carlsen (2022) asserts that income inequality stems from unobservable constraints. Expanding on this idea, Chen et al. (2023) and Cheah et al. (2021) explain that women are comparatively less likely to adopt Fintech services. The literature can therefore be interpreted as follows. Fintech has the potential to reduce income inequality. However, there is the potential that pre-existing social constraints associated with female financial inclusion, may limit the effect of Fintech in reducing gender inequality. Disentangling which situation is more likely can contribute to knowledge, by extending sustainability debates.

Second, the World Bank stipulates that opening an i) Account is the first step to use other financial services¹. Opening an Account is recognized as an Access (passive) form of financial

inclusion. The next step in achieving social mobility is ii) Borrowing, and the final step is recognized as iii) Saving. Both are Active forms of financial inclusion, that require increasing amounts of equity. Previous studies infer that Fintech technology increases the propensity of firms to open an Account, due to the ease of access to financial services through internet banking (Arner et al., 2018; Ansar et al., 2018 ; Demir et al., 2022). However, whether Fintech has the potential to increase financial inclusion through Active opportunities that require increasing levels of equity, is a question left unanswered. Evidence that Fintech’s effect in promoting financial inclusion is lower for activities that require increasing levels of equity, contributes to knowledge by providing nuanced interpretations. More specifically, by introducing the supposition that access to equity can be the pre-existing social constraint, which limits Fintech’s effect in reducing gender inequality.

Third, gender inequality is more prevalent in developing, low-income countries, compared to developed economies (Jain-Chandra et al., 2017; Demirgüç-Kunt et al., 2015). Tang (2022) acknowledges that in developing countries, gender inequality may stem from financial exclusion. Kara et al. (2021) provide evidence that females are more likely to be rejected from financial services, deprived from formal credit, and pay higher cost. In this regard we are motivated to investigate whether the impact of Fintech on gender inequality through financial inclusion is different across countries with differing levels of gender inequality. Whether countries with differing gender inequality levels would be impacted differently or similarly, by Fintech and financial inclusion, based on the gender inequality at country-level is a question left unanswered. To contribute to knowledge, we partition our sample based on gender inequality levels (10th, 25th, 75th, 90th percentiles), to capture the effect of Fintech and financial inclusion on gender inequality. Evidence that the impact of Fintech and financial inclusion on gender inequality is similar/dissimilar across regions with different gender inequality, would contribute to knowledge, by indicating the extent to which the phenomenon is isolated to high gender inequality regions, or a universal problem.

Fourth , we are motivated to contribute to policy debates. Gender equality is considered one of the most important objectives of the United Nations (UN). The G20 High-Level Principles for Digital Financial Inclusion (G20-HLP-DFI) is considered as a policy to enact the UN’s gender equality objectives, by promoting the financial inclusion of females (Fu and Ghurani, 2025). G20-HLP-DFI identifies Fintech as a driver to meet these joint objectives. Evidence that Fintech’s effect in reducing gender inequality is constrained by pre-existing social constraints, can speak to policy

debates. More specifically, if barriers associated with equity acquisition limit the participation of females in Active financial inclusion activities, that promote social mobility (Saving and Borrowing), Fintech may not be the solution that policymakers hope. This view is consistent with Kaplinsky and Kraemer-Mbula (2022), who argue that a pivot in techno-economic paradigms, equally require complementary societal-level changes. Fifth, in an instance where empirical results imply that Fintech's effect in reducing gender inequality is limited by financial inclusion, we are motivated to provide a normative perspective about how education can be a policy/action to reduce the gender gap.

Using data for a sample of 147 countries over the 2011-2021 period, the results of machine learning techniques and quartile OLS regression provide evidence that Fintech promotes financial inclusion. More specifically, through the availability of a phone banking app, more females are able to open an Account (Access) and engage in Borrowing and Saving (Active). However, when we investigate Fintech's effect in reducing gender inequality, through financial inclusion, empirical findings show that results are only significant in terms of opening and Account. For Active inclusion activities such as Borrowing and Saving, results remain inconsistent. The results suggest that pre-existing social constraints associated with access to equity mitigate the effect of Fintech in reducing gender inequality. When the sample is divided by time, income level, region, and development stage, the results remain indifferent. In summary (1) Fintech increases gender inequality, (2) gender inequality is only reduced through Access (Account ownership) and not through usage (Saving and Borrowing). Results are consistent when the sample is partitioned into quartiles based on country-level gender inequality. Taken together, the results suggest that Fintech may not be the solution perceived by legislators in reducing the gender gap. To avoid unnecessary repetition, the contributions associated with these findings are discussed in detail in section 6.

The remainder of the paper proceeds as follows. In section 2, relevant literature is reviewed, and hypotheses are introduced. In section 3 we introduce the research methodology. In section 4, descriptive statistics and empirical results are presented. Additional analysis is presented in section 5. Finally, contributions are introduced in section 6. Moreover, areas of future research, policy suggestions, and limitations are discussed.

2. Literature review

Fintech and financial inclusion

In Honohan’s (2005) seminal study, two core dimensions of inclusive finance are introduced, based on demand and supply. In the 2010s, these dimensions are extended into three categories, specifically (i) Penetration, (ii) Access or Availability, and (ii) Usage (Kumar, 2013; Mukhopadhyay, 2016; Sarm, 2016). More recently, financial inclusion measurement has been conceptualized in terms of Access to financial services (Accounts Ownership), and Active usage (Borrowings and Savings). Demir et al. (2022) provide empirical evidence that Fintech increases Access and Active financial inclusion. Similarly, Ansar et al. (2018) emphasizes this view, stating that Fintech enables underbanked populations to access the financial system. However, as is indicated by the world bank, the next step in financial inclusion is participating in Active usage, which includes services such as Savings and Borrowing¹. As discussed in numerous studies, Active financial inclusion refers to the use of financial products such as savings, credit and deposits, which promote social mobility (Ambarkhane et al., 2016; Beck et al., 2007b; Honohan, 2008; Kim, 2016).

The effect of Fintech on financial inclusion is perceived from two perspectives in the extant literature. Firstly, proponents assert that Fintech innovations serve as an important driver of financial inclusion (Ghosh, 2016; Ha et al., 2021; Jack and Suri, 2011; Mbiti and Weil, 2015; Pal et al., 2021; Tchamyu et al., 2019; Tchidi et al., 2025). Fintech is shown to reduce homosexuality bias in Africa (Kabengele & Hahn, 2025). Empirical studies show that households adopting Fintech solutions, for example mobile money services, are more likely to own bank accounts, engage in sending and receiving remittances, and accumulate savings (Jack & Suri, 2011; Mbiti & Weil, 2015; Morawczynski, 2009; Ouma et al., 2017). Moreover, it is recognized that Fintech innovations offer new opportunities to mitigate these inequalities by facilitating financial inclusion by expanding financial access to financial services, facilitating entrepreneurship, and lowering the barriers of entry into labor markets (Bayrakcı & Köse, 2019; Demir et al., 2022; Guo et al., 2021). Digital credit platforms enhance female participation in financial services by enabling women entrepreneurs to access credit independently from traditional banking systems. Similarly, mobile payment systems provide non-bank individuals entry points into the formal financial system (Komürcüoğlu & Komürcüoğlu, 2025). Similarly, as explained by Philippon (2019), Big Data tools utilized by Fintech are reported to provide access to the credit market on a non-biased basis. Bartlett et al. (2018) report that Fintech reduces negative prejudices, with algorithms discriminating 40% less than face-to-face lenders. Moreover, according to Berg et al. (2020, 2019), Fintech algorithms have more predictive power that matches or exceeds traditional face-to-face

lenders or credit bureau scores. Taken together, evidence exists to argue that Fintech enhances financial inclusion.

On the other hand, some critics argue that Fintech does not have a positive effect on financial inclusion. Whilst Fintech lenders could serve more creditworthy borrowers, it is reported that they charge higher interest rates, typically in the region of 14-16 basis points (Buchak et al., 2018). It is argued that this outcome has two consequences: (1) Potential borrowers are deterred by the high interest rate and, hence, would be financially excluded; (2) Borrowers who accept higher rates would enter a vicious cycle of over-indebtedness. In a similar fashion Bartlett et al. (2018) reports that Fintech is found to be no different, compared to traditional lenders, in charging minorities a higher rate for mortgages and refinancing. Furthermore, Ediagbonya & Tioluwani (2023) surmise that despite the increasing use of Fintech in digital platforms by government, regulators and financial institutions, there is still a noticeable increase in the financial inclusion gap. Taken together, it can be argued that whilst Fintech has potential to enhance financial inclusion, this view is not accepted in the extant literature.

Financial inclusion and Gender inequality

Many argue that providing females access to the financial system can reduce poverty, hence reduce the gender gap (El Zoghbi et al., 2019; Klapper et al., 2016). However, Kara et al. (2021) reports that in emerging countries, females face a higher likelihood of being excluded from Active financial institution inclusion activities, such as Borrowing. It is also recognized that females are often required to pay higher interest rates. Morsy (2020) explains that to an education gap is a potential why females face a less favorable borrowing situation in developing countries. This view is reiterated by Rao (2015), who surmises that a lack of educational attainment coupled with lower financial literacy, could lead women to being less confident in filling loan applications, hence, more vulnerable to resorting to unfavorable and exploitative lending practices. Ghosh and Vinod (2015) envision that a solution to the gender inequality problem, can be the development of opportunities for educational attainment to enhance financial literacy, hence financial inclusion. The literature therefore infers that education may be a social constraint which can be a barrier to gender equality.

It is established that because financial institutions are profitmaking, groups perceived to be

of higher risk are financially excluded, or are required to pay higher interest rates (Aitken, 2014; 2010; Guérin et al. 2014; Mader, 2013). Giron et al. (2014) report that gender affects the financial inclusion opportunities that are available to male/females. More specifically, they find that females are excluded from formal Saving opportunities that are available to males. Dang and Nguyen (2021) provide a reason to explain why females have lower access to financial inclusion opportunities. More specifically, they report that females are more likely to permanently lose their jobs, compared to men, and have their income fall by 50% more than men. This study speaks to the unobservable social constraints that may exist in society, which reduce the potential to access equity to engage in Active financial inclusion. Taken together, the literature can be interpreted as follows. Financial inclusion may benefit society by reducing gender inequality. However, whether such benefits can be enacted through Fintech remains a question left unanswered.

Fintech and Gender Inequality

Fintech’s role in promoting gender equality is interpreted from two perspectives in the extant literature. Firstly, Tripathi and Rajeev (2023) find that Fintech is a significant technological development which allows females access to financial services, conveniently on mobile phones. The use of Fintech credit algorithms are also shown to significantly increase loan approvals, hence reduce gender inequality in bank loans. For example, Song et al. (2024) report that female loan approval rates improved by 8% when Fintech algorithms were adopted by banks. The same study shows that the effect is more substantial for banks with higher baseline gender bias in credit decisions. Fintech, with its utilization of algorithms and big data, is also shown to have the potential to reduce gender bias in credit decisions, and hence promote financial inclusion (Makina, 2019; Ozili, 2021; Purda & Ying, 2022). By relying on algorithms and machine learning, Fintech companies can be perceived to avoid human biases in traditional credit decision-making processes (Johnson et al., 2019; Lui & Lamb, 2018; Packin & Lev-Aretz, 2018). In particular, many argue that algorithms can be designed to use a broader range of data sources, including non-traditional ones such as social media and online shopping patterns, which can capture a more comprehensive picture of an individual’s creditworthiness (Hurley & Adebayo, 2016; Makina, 2019; Peng & Zhu, 2021; Purda & Ying, 2022; Sadok et al., 2022). In summary, an argument exists in the literature which infers that Fintech can have the potential to reduce gender inequality.

Second, Kömürçüoğlu & Kömürçüoğlu (2025) provide evidence that whilst Fintech reduces

male and female unemployment rates, it does not offer sufficient opportunities to reduce gender inequality. Sparks & Eckenrode (2020) claim that whilst Fintech is revolutionizing finance, there is no consideration of the significant gender imbalance that exists in society. Fintech is also argued to be having a narrowing impact on the class and rural divide, but no impact on the gender divide (Tok & Heng, 2022). Within the Fintech industry, the few studies on gender inequalities that exist provide evidence of striking disparities. In the UK, women account for 28% of the Fintech workforce (Kimber, 2023), with 17% of senior Fintech roles taken up by females (Fox-Robertson & Wojcik, 2024). Sparks & Eckenrode (2020) reported that only 12.2% of the 3,017 Fintech startups in 2019 had at least one-woman (co-)founders. The challenge to gender inclusion for borrowers and within the Fintech industry is identified by Demir et al. (2022), who argues that a collective challenge exists that holds the Fintech ecosystem accountable, to make it a more inclusive, equitable, and attractive environment for females.

Taken together, the literature can be summarized as follows. Fintech technology is likely to promote females' financial inclusion. More specifically, the establishment of mobile banking apps are likely to allow a greater number of females open an Account at a financial institution. We also envision that Fintech technology will allow females the opportunity to participate in Active forms of financial inclusion (Borrowing and Saving). However, due to preexisting inequalities that exist in society, we only expect that Fintech technology will reduce gender inequality through Access forms of financial inclusion. More specifically, there can be an expectation that when females are able to access online banking, numerous benefits can be enjoyed. On the other hand, we do not expect that Fintech will have a negative impact on gender inequality through Active financial inclusion. More specifically, due to (perceived) education and employment constraints, females are less likely to have access to equity. As a result, females are less likely to be able to participate in financial inclusion activities that promote social mobility, such as Borrowing and Savings. Based on the above, the following hypotheses are introduced:

H.1. Fintech will reduce gender inequality through financial inclusion in terms of Access (Account ownership)

H.2. Due to societal constraints, Fintech may not reduce gender inequality in terms of Active usage (Borrowing and Saving).

3. Research Methodology

Model

We borrow from the model introduced by Demir et al. (2022), which is adapted from Altunbas & Thornton (2019). The former investigates the potential income inequality reducing effect of financial inclusion. The latter focuses on the impact of financial development on income inequality. Model (1) is different, as it focuses specifically on the impact of i) Female Fintech adoption can have on reducing ii) Gender inequality (within-country), through iii) Financial Inclusion. A visual representation of the study’s main regression Model (1) is illustrated below:

$$GI_{i,t} = a_0 + a_1Fintech_{i,t} + a_2FinancialInclusion_{i,t} + \sum_{k=1}^K \rho_k X_{k,i,t} + U_{i,t} \quad (1)$$

<Insert Table 1 here>

A list of variable definitions is listed in Table 1. As shown in Panel A, the dependent variable, *GII*, refers to values presented in the Gender Inequality Index. As defined in the Human Development report¹, *GII* is a composite metric of gender inequality using three dimensions, i) reproductive health, ii) empowerment and iii) the labor market. A low *GII* value indicates lower inequality between women and men, and vice-versa. *GII* is an established measure to indicate gender inequality in the extant literature (Ohiomu & Ogbeide-Osaretin, 2019; Seth, 2009). Borrowing from Demir et al. (2022), *Fintech* is an empirical representation of the percentage of females that are over 15, which have used their phone to pay bills (% age 15+). A negative association between *Fintech* and *GII*, infers that female Fintech adoption reduces gender inequality. A positive association would infer that Fintech increases the gender gap. To recognize the effect female *Fintech* adoption can have on *GII*, through financial inclusion, Model (2) is introduced to capture the mediating impact of *FinTech* on *Financial Inclusion*. *Financial Inclusion* metrics are listed in Panel B. Utilizing Allen et al’s. (2016) approach, *Financial Inclusion* is captured empirically as the percentage of females aged 15 and more who have an i) *Account*, have ii) *Saving(s)* iii) and *Borrowing(s)* at a financial institution. If the association between *Financial Inclusion* and *Fintech* is positive in Model (2), and the association between *Fintech* and *GII* is negative in equation (1), it would infer that financial inclusion is not a factor which mitigates the effect of Fintech on *GII*. If *Financial Inclusion* does mitigate the effect

¹ <https://hdr.undp.org/data-center/thematic-composite-indices/gender-inequality-index#/indicies/GII>

of *Fintech* technology on *GII*, the association between *Fintech* and *GII* would be positive in equation (1). As explained above, we expect the former association with access financial inclusion opportunities such as opening an *Account* (H.1.), and the latter association with active saving opportunities such as *Borrowing* and *Saving*, H.2. All Financial Inclusion data is obtained from The Global Financial Inclusion index (Global Findex).

$$Financial\ Inclusion_{i,t} = a_0 + a_1 Fintech_{i,t} + \sum^K \rho_k X_{k,i,t} + U_{i,t}(2)$$

Control variables

The following independent variables are added as controls in models (1) and (2) (*Education*, *Redistributive Policies*, *Trade*, *Population Growth*, *GDP Growth*, *GDP*, and *Institutional Quality* see Table 1). *Education* is a critical determinant of financial inclusion and a mitigator of inequality. Education can improve income levels of women (Pahlevan Sharif et al., 2023; Riddell & Song, 2011), increase financial access (Lotto, 2018; Morgan & Trinh, 2019), reduce poverty levels and, by extension, reduce financial inequalities (Neaime & Gaysset, 2024; Neaime & Gaysset, 2018). *Education* is expected to have a negative association with *GII*, and a positive relationship with *Financial Inclusion*. Similarly, *Redistributive policies* such as taxes and transfer systems (Guillaud et al., 2020; Zucman, 2019), social welfare programs (Demirgüç-Kunt et al., 2020; Acemoglu & Robinson, 2013), and subsidies (Bazzi et al., 2021; Piketty, 2014) have been associated with gender inequality and financial inclusion. Properly targeted (and implemented) *redistributive policies* could lead to increased financial access and thus reduce financial inequalities (Bazzi et al., 2021; Auclert, 2019). *Redistributive Policies* are therefore predicted to have a negative association with *GII*, and a positive relationship with *Financial Inclusion*.

Another key control variable, *Trade*, is associated with financial inclusion and gender inequality through its effects on labor markets and economic integration (Autor et al., 2016; Porto & Conti, 2020). While trade openness may widen inequality by favoring skilled labor (Chinoda & Mashamba, 2021; Jaumotte et al., 2013), it can also stimulate job creation and financial access. *Trade* is expected to have a negative association with *GII*, and a positive relationship with *Financial Inclusion*. In contrast, *Population Growth* can increase income disparities, by straining resources (Ashraf et al., 2021; Neaime & Gaysset, 2024). Therefore, *Population growth* is expected to have a

positive association with *GII*, and a negative relationship with *Financial Inclusion*.

There is evidence that GDP growth is associated with reductions in inequality and financial inclusion (Beck et al., 2008). However, this relationship is not unidirectional indicating that financial development may initially worsen inequality before long-term improvements (Greenwood & Jovanovic, 1990). *GDP growth* is therefore expected to have a positive association with *GII*, and a negative relationship with *Financial Inclusion*. On the other hand, GDP per capita directly improves financial inclusion (Demirgüç-Kunt & Klapper, 2012). However, equitable growth policies are critical for reducing inequality (Cuesta & Agostino, 2021; Dabla-Norris et al., 2015). *GDP per capita* is predicted to have a negative association with *GII*, and a positive relationship with *Financial Inclusion*. Finally, investments in financial markets are shown to play an instrumental role in redistributing economic resources and promoting long-term productivity (Beck et al., 2008; Merton & Bodie, 1995). Thus, there is an expectation that *Institutional Quality* can have a negative relationship with *GII*, and a positive relationship with *Financial Inclusion*.

Sample Selection

While the control variables are available on a yearly basis, *GII* data is only available on a three year ‘wave’ basis (2011, 2014, 2017, 2021). Therefore, the analysis consists of data observations included in these waves. Based on data availability, the sample consists of 147 countries.

4. Empirical results

Descriptive Statistics

Table 2 provides summary statistics (after data cleaning). For the sample of 145 countries, there are a total of 580 observations, across the 4 waves. Total countries after cleaning the data for missing values for each wave are (2011 (104), 2014 (89), 2017 (80), 2021 (47)) 318 observations. Because the number of observations is large, we report untabulated results for country specific determinants. Denmark is recognized as having the lowest level of gender inequality (2021), as well as the highest level of female Fintech adopters. With regards to Financial Inclusion, the country where females have the highest level of Account ownership is Canada. Females in Sweden are

shown to have the highest levels of Saving and Borrowing. Panama is recognized as possessing the highest level of gender inequality. The lowest in terms of female Fintech adoption, Borrowing, Savings and Account ownership, are Turkmenistan, Algeria, Yemen and Turkmenistan respectively.

<Insert Table 2 here>

We report untabulated results that the Max-Min range levels for female Fintech adoption; all three Financial Inclusion measures; and GII are different based on country's income status. The association between gender inequality and income is delineated in Figure 1. Figure 1 reports that as a country's income group decreases, gender inequality increases. Figure 2 provides details about the association between county level income, i) % of females that have adopted Fintech, and those who have ii) an Account, ii) Saving(s), or iii) Borrowing from a formal financial institution at a specific country.

<Insert Figure 1 here>

<Insert Figure 2 here>

Figures 2, a-d indicate that lower income countries suffer lower female Fintech adoption, and that females face lower access to Accounts, Savings and Borrowing. On the other hand, countries classified in higher income groups enjoy higher Fintech adoption, and higher levels of Accounts, Savings and Borrowing. Both Figure 1 and 2 highlight how low-income economies suffer from higher gender inequality. These descriptive statistics raise an important question. More specifically, what can be the differential effect of Fintech, on gender inequality, through financial inclusion, based on a country's gender inequality status. This constitutes the substance of the quantile analysis conducted in Table 8, formally assessing whether the impact of Fintech and financial inclusion on gender inequality is equal/different, based on country partitioning.

Correlation test

Table 3 provides the results of Pearson correlations. As expected, there is a strong negative association between *Gender Inequality* (GII), *Fintech* (-0.176**) and *Account* (-0.597***), *Savings* (-0.446***), *Borrowing* (-0.368***). *Fintech* is an empirical representation of the

percentage of females that are over 15, which have used their phone to pay bills (% age 15+). *Financial Inclusion* is captured empirically as the percentage of females aged 15 and more who have an i) Account, have ii) Savings iii) and Borrowing at a financial institution, using mobile technology. Therefore, there is the potential for a multicollinearity problem to influence the results. To exclude the potential of a multicollinearity problem, we conduct Variance Inflation Factor tests for the model and each variable. We report untabulated results that for all variables in the model, VIF scores are lower than 2. This result suggests that multilinearity is not a concern for the model.

<Insert Table 3 here>

Economic Strategy

This study investigates if financial inclusion is mediating the effect of Fintech on gender inequality. We also use different measures of financial inclusion and test how they affect gender inequality. The empirical strategy proceeds as follows: (1) Run *t* test to evaluate the presence of gender inequality, gender gap in Fintech adoption, financial access (Account ownership) and financial use (Saving and Borrowing) (2) Test how Fintech affects financial inclusion using pooled OLS regression (model 2); (3) Examine the effect of Fintech on gender inequality in Model (1). We then include in the model control variables that have been found to affect gender inequality, and check if the coefficient on Fintech changes significantly. Finally, we add financial inclusion proxies into the model and examine how this measure affects gender inequality. (4) Next, we run quantile regressions to examine the potentially differential effects of Fintech and financial inclusion can have on gender inequality across countries with different levels of gender inequality. (5) We run three robustness checks including : (a) an endogeneity test, (b) panel year, income, and development stage’ fixed effects models, and (c) machine learning algorithms to evaluate the importance of the variables in affecting gender inequality.

Main results

Table 4 provides mean levels of male/female Fintech adoption, and t-tests, comparing the usage of financial services. The adoption of Fintech for males and females is not different. However, there is a statistically significant difference between males and females in terms of

Financial Inclusion proxies (Account, 0.003***, Saving, 0.001*** and Borrowing, 0.000***). In Table 5, it is recognized that a male-female gender gap exists (GII 0.000***). Taken together, descriptive statistics provide evidence consistent with previous studies that acknowledge the existence of gender inequality in society.

<Insert Table 4 and 5 here>

In Table 6, we report the results from model (2), which captures the effect of female Fintech adoption on Financial Inclusion measures. Empirical results show that female Fintech adoption increases financial inclusion via three measures: Account (0.134***), Saving (0.270***) and Borrowing (0.428***). These results are consistent with previous research which argue that Fintech has a positive impact on both Access and Active forms of financial inclusion (Bartlett et al., 2018; Berg et al., 2020; Buchak et al., 2018; Jack & Suri, 2011; Ghosh, 2016; Gosavi, 2018; Mbiti & Weil, 2015; Morawczynski, 2009; Ouma et al., 2017; Tchamyou et al., 2019).

<Insert Table 6 here>

Table 7 presents the results of the main regression analysis, model (1), which investigates the impact of Fintech and Financial Inclusion, on GII. In the first column, GII, is regressed on Fintech only. In the second column, control variables are added to the regression. The results show that in the first column, Fintech significantly reduces GII (-0.035 ***). However, Fintech starts to increase gender inequality once the control variables have been added. This indicates that other control variables (institutional quality, Education, trade, GDP) have higher predictive validity and are more influential in reducing gender inequality, as compared to Fintech adoption.

<Insert Table 7 here>

In the third, fourth, and fifth columns, financial Inclusion proxies are added. For all models, empirical results imply that that Fintech adoption increases gender inequality, rather than reducing it. However, Account ownership significantly decreases gender inequality (-0.067***). Interestingly, there is no significant impact on *Borrowing* and *Savings* on *GII*. We interpret the results as follows. Opening an Account is the financial inclusion measure that requires the lowest level of equity for participation. Active forms of financial inclusion, such as Borrowing and Savings require higher levels of equity. The results therefore infer that Fintech provides females an

opportunity to open an Account, consistent with H.1. However, due to pre-existing social constraints, Fintech technology alone may not be sufficient to enhance the social mobility of females through Borrowing or Savings, consistent with H.2.

Next, we examine whether the impact stated above varies across countries, with different gender inequality levels, based on the 10th , 25th , 50th , 75th and 90th percent quantiles. The 10th quartile indicates the lowest levels of gender inequality. The 90th quartile represent the highest level of gender inequality. To the best of our knowledge, whether through *Fintech*, *Financial Inclusion* reduces *GII*, regardless of the country-level gender inequality, is a question left unanswered. The result from this analysis is presented in Table 8.

<Insert Table 8 here>

The first five columns report the regression results for the propensity of females to open an Account. The signs of the quantile regression are consistent with the results in Table 7, indicating that an increase in the proportion of the population with an account at a formal financial institution is associated with a reduction in gender inequality, at all quantiles of the gender inequality partitioning. We also note that the Account ownership effect in reducing *GII* diminishes in countries with high gender inequality. The results also show how Fintech becomes more significant in increasing gender inequality, especially in countries with higher gender inequality (75th and 90th quantile).

The second five columns (6-10) and third five columns (11-15), provide results regarding the impact of Saving and Borrowing on *GII* across the 5 quartiles of gender inequality. The results show an insignificant impact of both metrics on gender inequality. This is in conformity of the aggregate results obtained in Table 7. The results also reiterate the role of Fintech in increasing gender inequality, especially in countries with higher gender inequality (75th and 90th quantile). From this quartile analysis and the aggregate results in Table 7, it is apparent that Financial Inclusion can reduce gender inequality is terms of access to Account ownership, but not in terms of active usage through Saving and Borrowing, consistent with H.1. and H.2. The results also reiterate that the gender inequality increasing effect of Fintech is more significant in countries with higher gender inequality.

5. Robustness Checks

The fifth step is to run three robustness checks. More specifically: (a) endogeneity testing, (b) year, country-level income, and development stage fixed effects models, and (c) machine learning algorithms.

Endogeneity test

To ensure that Fintech and the financial inclusion metrics are free from endogeneity, we follow the model of Demir et al. (2022) which includes (a) Fixed Broadband Penetration' and (b) Mobile phone subscription as instrumental variables. The Wu-Hausman test seeks to identify if there is a significant difference between the coefficients from the OLS estimate and the two stage least squares estimates (2SLS) which uses the instrumental variables. For the main explanatory variables not to be endogenous, the Wu-Hausman test p-value needs to be greater than the critical value of 5%. A test value that of <5% would indicate a significant difference between the two types of regression. A value that of >5% would indicate that there is no significant difference between the two regressions and hence the OLS regression provides consistent estimates. The results in line one from Table 9 indicate that Fintech is not an endogenous variable in impacting gender inequality, when included along the financial inclusion variables: Account ownership, Saving and Borrowing. Similarly, row 2 indicates that the Financial Inclusion variables: Account ownership, Saving and Borrowing are not endogenous variables in impacting gender inequality when included alongside the Fintech variable. The above provide evidence that the model is free from endogeneity concerns.

<Insert Table 9 here>

Fixed effects: Time, Income group, Development stage

Next, we investigate whether results are consistent after controlling for i) a countries' income level, ii) time-period, and iii) country development stage. In the first analysis, years in waves relating to 2011, 2014, 2017 and 2021, are allocated a dummy variable for each year (1), 0 otherwise. In the second analysis, developing countries are assigned a value of 1. Developed

countries are assigned a value of 0. In the third analysis, dummy variables are assigned a 1/0 dummy variable based on lower, lower-middle, and higher-middle income, and high income status. When we introduce these additional dummy variable controls into model, untabulated results remain qualitatively indifferent, adding additional robustness to our analysis.

Machine learning

Machine learning (ML) analysis investigates the impact of Fintech’s effect on GII through Financial Inclusion. Table 10 compares 10 ML models, and identifies the best model for each regression, based on their R2. In our initial analysis, the Extra Trees Regressor (ET) model is found to be superior in accuracy, compared to the remainder of the ML modules.

<Insert Table 10 here>

Figure 3 shows the results of the variables importance, followed by the features selection. The purpose of the variable importance approach is to rank variables in terms of their significance, while the feature selection help isolate non-significant factors. The results in Figure 3 are consistent with the results obtained in Table 7 and 8. Namely, variables importance figures show that Account ownership is higher, compared to Saving and Borrowing in terms of impacting gender inequality. This is further confirmed by the features selection graphs. Account ownership is ranked as feature 2, while the features selection stops at 8. On the other hand, Saving is ranked 5th, while the features selection stops at the fourth variable. Similarly, Borrowing is ranked 7th, while the features selection stops at the sixth variable. These results provide additional support to previous results, that Account ownership is the only financial inclusion metric to impact gender (in)equality. Again, these results add support to H.1. and H.2.

<Insert Figure 3 here>

6. Conclusion

This study makes numerous important contributions to knowledge. First, there are disagreements regarding the impact of Fintech in promoting financial inclusion. Proponents argue that Fintech promotes financial inclusion, through enabling customers to have greater to access to

financial services, and by extension usage (Ansar et al. 2018; Arner et al., 2018; Demir et al., 2022; Ghosh, 2016; Jack & Suri, 2011; Mbiti & Weil, 2015; Tchamyoun et al., 2019). On the other hand, critics argue that Fintech's effect in promoting financial inclusion is limited (Bartlett et al., 2018; Komürçüoğlu & Komürçüoğlu, 2025; Philippon, 2019). Consistent with former assertion, we extend the literature with evidence that on an international basis, Fintech promotes financial inclusion for females in terms of Access (opening and Account), and Active services (Borrowing and Saving).

Second, Carlsen (2022) argues that Fintech's effect in reducing inequality is now well-understood in the extant literature. Many argue that Fintech has the potential to reduce gender inequality, through the use of algorithms, which reduce inherent biases that prevent access to financial services (Johnson et al., 2019; Lui & Lamb, 2018; Packin & Lev-Aretz, 2018; Song et al., 2024; Loco & Yang, 2022). On the other hand, it is argued that Fintech may not be instrumental in reducing gender inequality, due to social constraints (Kömürçüoğlu & Kömürçüoğlu 2025; Sparks & Eckenrode, 2020). Our empirical results offer nuance to extend these interpretations. More specifically, we provide empirical evidence that in an instance where females open an Account, Fintech can reduce gender inequality. However, Fintech is shown to not enact a reduction gender inequality through active forms of financial inclusion that enhance social mobility (Borrowing and Saving). We interpret the results as follows. There is the potential for the algorithms used in Fintech may reduce biases. However, the social inequality that females are likely to face as a result of restricted access to equity, may not be overcome by Fintech adoption alone. In summary, we surmise that social inequality is an inherent limitation to Fintech technology's effect in reducing the gender gap.

Third, prior to this study, the incremental effect of financial inclusion and female Fintech adoption on gender inequality, regardless of the country-level gender inequality, remained a question left unanswered. We report that regardless of gender inequality partitioning, Account opening is the only financial inclusion activity which reduces gender inequality. Interestingly, for those countries classified as possessing lower levels of gender inequality, female Fintech adoption is shown to not have an incremental effect on gender (in)equality. On the other hand, in high gender inequality countries, female Fintech adoption is shown to increase gender inequality. This finding adds further support to our assertion that equity unavailability is the social constraints that mitigates the effect of Fintech in reducing gender inequality. The study also contributes to

knowledge by inferring that in countries with higher gender inequality, Fintech technology may exacerbate the gender gap.

As explained in the introduction, a key goal of the UN2030 Agenda for Sustainable Development (UN-2030-ASD) is the promotion of gender inequality. An associated policy is the G20 High-Level Principles for Digital Financial Inclusion (G20-HLP-DFI), which aims to increase financial inclusion through innovative technologies such as Fintech. There is an expectation that UN-2030-ASD's gender inequality objectives will be enacted by G20-HLP-DFI's vision that financial inclusion through Fintech technology will reduce the gender gap. However, our results suggest that at this time, Fintech's effect will have a limited effect in achieving this objective, due to aforementioned constraints.

Fourth, a normative perspective is introduced, to explain how interventions may be adopted to enhance Fintech's effect in reducing gender inequality, through financial inclusion. Lotto (2018) argues that education is a key factor for equitable access to finance. Neaime & Gaysset (2024, 2018) suggest that access to education will reduce poverty levels, and by extension, financial inequalities. Many argue that educated individuals are more likely to secure higher-paying jobs, save surplus income, and qualify for financial products such as credit (Spath & Schmid, 2018; Riddell & Song, 2011). Thus, we posit that for Fintech to reduce the gender gap, barriers that constrain female's access to equity would need to be removed in the first instance. If such an aspiration was successfully enacted, Fintech's positive effect in reducing the gender gap may be manifested.

Finally, we introduce a limitation. We approach this study from the theoretical perspective that male and females are equal in every sense. The study ignores that females may prefer to adopt paternal roles as mothers, and therefore simply may not have an inclination for Active financial inclusion opportunities such as Saving and Borrowing. A different interpretation of our results can therefore be, females may have less of an inclination to engage in active financial inclusion, due to roles as primary care givers. Future studies may investigate i) whether the results are a representation of the perceptions/acceptance of some females to allocate active financial duties (Borrowing and Saving) to partners, or on the other hand ii) the extent to which the results indicate social injustice. To disentangle which situation is more likely, studies that conduct interviews and collect questionnaire data may highlight the different attitudes of females towards Fintech adoption in terms of Active and Access opportunities.

References

- Altunbaş, Y., & Thornton, J. (2019). The impact of financial development on income inequality: A quantile regression approach. *Economics Letters*, 175, 51–56. <https://doi.org/10.1016/j.econlet.2018.12.030>
- Ambarkhane, D., Singh, A. S., & Venkataramani, B. (2016). Measuring financial inclusion of Indian states. *International Journal of Rural Management*, 12(1), 72–100. <https://doi.org/10.1177/0973005216633940>
- Ansar, S., Singer, D., Klapper, L., & Demirgüç-Kunt, A. (2018). *The Global Findex Database 2017: Measuring financial inclusion and the Fintech Revolution*. World Bank Group. <https://doi.org/10.1596/978-1-4648-1259-0>
- Arner, D. W., Buckley, R. P., & Zetzsche, D. A. (2018). Fintech for financial inclusion: A framework for digital financial transformation. *UNSW Law Research Paper No. 18-83*. <http://dx.doi.org/10.2139/ssrn.3245287>
- Ashraf, Q., Galor, O., & Klemp, M. (2021). Heterogeneity and the dynamics of technology adoption. *Journal of Development Economics*, 150, 102615. <https://doi.org/10.1016/j.jdeveco.2021.102615>
- Ashoer, M., Jebarajakirthy, C., Lim, X. J., Mas'ud, M., & Sahabuddin, Z. A. (2024). Mobile fintech, digital financial inclusion, and gender gap at the bottom of the pyramid: An extension of mobile technology acceptance model. *Procedia Computer Science*, 234, 1253–1260. <https://doi.org/10.1016/j.procs.2024.03.122>
- Auclert, A. (2019). Monetary policy and the redistribution channel. *American Economic Review*, 109(6), 2333–2367. <https://doi.org/10.1257/aer.20160137>
- Autor, D. H., Dorn, D., & Hanson, G. H. (2016). The China shock: Learning from labor market adjustment to large changes in trade. *American Economic Review*, 106(6), 2051–2114. <https://doi.org/10.1257/aer.20131627>
- Bartlett, R., Morse, A., Stanton, R., & Wallace, N. (2018). *Consumer-lending discrimination in the era of fintech* [Unpublished working paper]. University of California, Berkeley.
- Bayrakçı, E., & Köse, S. (2019). Kadın girişimcilğinde “Bir Tık” ötesi: Kadın dijital girişimler üzerine nitel bir araştırma. *Girişimcilik İnovasyon ve Pazarlama Araştırmaları Dergisi*, 3(6), 95–106. <https://doi.org/10.31006/gipad.483860>
- Bazzi, S., Gaduh, A., Rothenberg, A. D., & Wong, M. (2021). Skill transferability, migration, and development: Evidence from population resettlement in Indonesia. *American Economic Journal: Applied Economics*, 13(1), 38–80. <https://doi.org/10.1257/app.20180338>
- Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of Economic Growth*, 12(1), 27–49. <https://doi.org/10.1007/s10887-007-9010-6>
- Beck, T., Demirgüç-Kunt, A., & Martinez Peria, M. S. (2008). Banking services for everyone? Barriers to bank access and use around the world. *The World Bank Economic Review*, 22(3), 397–430. <https://doi.org/10.1093/wber/lhn020>
- Beck, T., Levine, R., & Levkov, A. (2010). Big bad banks? The winners and losers from bank deregulation in the United States. *The Journal of Finance*, 65(5), 1637–1667. <https://doi.org/10.1111/j.1540-6261.2010.01589.x>
- Bellemare, M. F., Masaki, T., & Pepinsky, T. B. (2017). Lagged explanatory variables and the estimation of causal effect. *The Journal of Politics*, 79(3), 949–963. <https://doi.org/10.1086/690946>
- Benería, L., Berik, G., & Floro, M. (2015). *Gender, development and globalization: Economics as if all people mattered*. Routledge. <https://doi.org/10.4324/9780203107935>
- Berg, T., Burg, V., Gomboiç, A., & Puri, M. (2020). On the rise of fintechs: Credit scoring using digital footprints. *The Review of Financial Studies*, 33(7), 2845–2897. <https://doi.org/10.1093/rfs/hhz099>
- Bertay, A. C., Dordevic, L., & Sever, C. (2025). Gender inequality and economic growth: Evidence from industry-level data. *Empirical Economics*, 68(1), 1–36. <https://doi.org/10.1007/s00181-024-02698-6>
- Bihari, S. C. (2011). Financial inclusion for Indian scene. *SCMS Journal of Indian Management*, 8(4), 7–15.
- Buchak, G., Matvos, G., Piskorski, T., & Seru, A. (2018). Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics*, 130(3), 453–483. <https://doi.org/10.1016/j.jfineco.2018.03.011>
- Carlsen, L. (2020). Gender inequality and development. *Sustainability Science*, 15(3), 759–780. <https://doi.org/10.1007/s11625-019-00767-9>
- Cheah, W. C., George, A., & Xie, T. (2021). *Gender divides in the ASEAN payment ecosystem* (SSRN Working Paper No. 3893670). <https://doi.org/10.2139/ssrn.3893670>
- Chen, S., Doerr, S., Frost, J., Gambacorta, L., & Shin, H. S. (2023). The fintech gender gap. *Journal of Financial Intermediation*, 54, 101026. <https://doi.org/10.1016/j.jfi.2023.101026>
- Chinoda, T., & Mashamba, T. (2021). Fintech, financial inclusion and income inequality nexus in Africa. *Cogent Economics & Finance*, 9(1), 1986926. <https://doi.org/10.1080/23322039.2021.1986926>

- Cuesta, J., & Agostino, M. (2021). Financial inclusion and inequality: A review of recent evidence. *World Development*, 142, 105428. <https://doi.org/10.1016/j.worlddev.2021.105428>
- Dabla-Norris, E., Kochhar, K., Suphaphiphat, N., Ricka, F., & Tsounta, E. (2015). Causes and consequences of income inequality: A global perspective. *IMF Economic Review*, 63(1), 1–39. <https://doi.org/10.1057/imfer.2015.7>
- Dang, H. A. H., & Nguyen, C. V. (2021). Gender inequality during the COVID-19 pandemic: Income, expenditure, savings, and job loss. *World Development*, 140, 105296. <https://doi.org/10.1016/j.worlddev.2020.105296>
- Demir, A., Pesqué-Cela, V., Altunbas, Y., & Murinde, V. (2022). Fintech, financial inclusion and income inequality: A quantile regression approach. *The European Journal of Finance*, 28(1), 86–107. <https://doi.org/10.1080/1351847X.2020.1772335>
- Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Hess, J. (2018). *The Global Findex Database 2017: Measuring financial inclusion and the Fintech Revolution*. World Bank Group. <https://doi.org/10.1596/978-1-4648-1259-0>
- Demirgüç-Kunt, A., & Klapper, L. (2012). Measuring financial inclusion: The Global Findex Database. *Journal of Development Economics*, 99(1), 1–7. <https://doi.org/10.1016/j.jdeveco.2012.06.001>
- Demirgüç-Kunt, A., Klapper, L., Singer, D., & Van Oudheusden, P. (2020). The Global Findex Database 2020: Financial inclusion, digital payments, and resilience in the age of COVID-19. *Journal of Financial Economics*, 137(1), 1–20. <https://doi.org/10.1016/j.jfineco.2020.01.003>
- Demirgüç-Kunt, A., Klapper, L. F., Singer, D., & Van Oudheusden, P. (2015). *The Global Findex Database 2014: Measuring financial inclusion around the world* (World Bank Policy Research Working Paper No. 7255).
- Ediagbonya, V., & Tioluwani, C. (2023). The role of fintech in driving financial inclusion in developing and emerging markets: Issues, challenges and prospects. *Technological Sustainability*, 2(2), 100–119. <https://doi.org/10.1108/TECHS-10-2021-0017>
- El Zoghbi, M., Holle, N., & Soursourian, M. (2019). *Emerging evidence on financial inclusion*. CGAP. https://www.cgap.org/sites/default/files/publications/2019_07_FocusNote_Emerging_Evidence.pdf
- Epstein, G., & Grabel, I. (2006). *Financial policies for pro-poor growth*. United Nations Development Programme. http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/Financial_policy_RR.pdf
- Fox-Robertson, C., & Wójcik, D. (2024). The triple glass ceiling: Fintech gender inequalities. *Finance and Society*, 10(1), 137–156. <https://doi.org/10.2218/fas.2023.16>
- George, T. T., & Lazar, D. (n.d.). *The financial inclusion index: Insights and implications for G20 countries*.
- Ghosh, S. (2016). Does mobile telephony spur growth? Evidence from Indian states. *Telecommunications Policy*, 40(10–11), 1020–1031. <https://doi.org/10.1016/j.telpol.2016.05.009>
- Ghosh, S., & Vinod, D. (2017). What constrains financial inclusion for women? Evidence from Indian micro data. *World Development*, 92, 60–81. <https://doi.org/10.1016/j.worlddev.2016.11.011>
- Girón, A., Kazemikhasragh, A., Cicchiello, A. F., & Panetti, E. (2021). Financial inclusion measurement in the least developed countries in Asia and Africa. *Journal of the Knowledge Economy*, 12(4), 1–14. <https://doi.org/10.1007/s13132-021-00773-2>
- Gosavi, A. (2018). Can mobile money help firms mitigate the problem of access to finance in Eastern Sub-Saharan Africa? *Journal of African Business*, 19(3), 343–360. <https://doi.org/10.1080/15228916.2017.1396791>
- Greenwood, J., & Jovanovic, B. (1990). Financial development, growth, and the distribution of income. *Journal of Political Economy*, 98(5), 1076–1107. <https://doi.org/10.1086/261720>
- Guerin, I., Morvant-Roux, S., & Villarreal, M. (2014). *Microfinance, debt and over-indebtedness: Juggling with money*. Routledge.
- Guillaud, E., Olckers, M., & Zemmou, M. (2020). Four levers of redistribution: The impact of tax and transfer systems on inequality reduction. *Review of Income and Wealth*, 66(3), 444–466. <https://doi.org/10.1111/roiw.12408>
- Guo, Q., Chen, S., & Zeng, X. (2021). Does fintech narrow the gender wage gap? Evidence from China. *China & World Economy*, 29(5), 142–166. <https://doi.org/10.1111/cwe.12382>
- Ha, D., Nguyen, M., Nguyen, K., & Şensoy, A. (2025). Unveiling financial inclusion dynamics: Fintech's resonance in Association of Southeast Asian Nations (ASEAN). *International Journal of Finance & Economics*, 30(2), 1348–1371. <https://doi.org/10.1002/ijfe.2963>
- Honohan, P. (2005). *Measuring microfinance access: Building on existing cross-country data* (SSRN Working Paper No. 753568). <https://doi.org/10.2139/ssrn.753568>
- Honohan, P. (2008). Cross-country variation in household access to financial services. *Journal of Banking & Finance*,

- 32(11), 2493–2500. <https://doi.org/10.1016/j.jbankfin.2008.05.004>
- Hurley, M., & Adebayo, J. (2016). Credit scoring in the era of big data. *Yale Journal of Law & Technology*, 18, 148–216. <https://heinonline.org/HOL/P?h=hein.journals/yjolt18&i=148>
- Jack, W., & Suri, T. (2011). *Mobile money: The economics of M-PESA* (NBER Working Paper No. 16721). <https://doi.org/10.3386/w16721>
- Jain-Chandra, S., Kochhar, K., Newiak, M., Zeinullayev, T., & Zhuang, L. (2017). Gender inequality around the world. In *Women, work, and economic growth*, 8(1), 13–38. International Monetary Fund.
- Jaumotte, F., Lall, S., & Papageorgiou, C. (2013). Rising income inequality: Technology, or trade and financial globalization? *IMF Economic Review*, 61(2), 271–309. <https://doi.org/10.1057/imfer.2013.7>
- Johnson, K., Pasquale, F., & Chapman, J. (2019). Artificial intelligence, machine learning, and bias in finance: Toward responsible innovation. *Fordham Law Review*, 88(2), 499–515. <https://heinonline.org/HOL/P?h=hein.journals/flr88&i=515>
- Juhn, C., Ujhelyi, G., & Villegas-Sanchez, C. (2014). Men, women, and machines: How trade impacts gender inequality. *Journal of Development Economics*, 106, 179–193. <https://doi.org/10.1016/j.jdeveco.2013.09.009>
- Kabengele, C., & Hahn, R. (2025). Venture capital funding in Africa: a mixed-methods study of evolving ecosystems and financial discrimination. *Journal of International Business Studies*, 1-18. doi.org/10.1057/978-1-137-57878-5_14
- Kaplinsky, R., & Kraemer-Mbula, E. (2022). Innovation and uneven development: The challenge for low-and middle-income economies. *Research Policy*, 51(2), 104394.
- Kara, A., Zhou, H., & Zhou, Y. (2021). Achieving the United Nations' sustainable development goals through financial inclusion: A systematic literature review of access to finance across the globe. *International Review of Financial Analysis*, 77, 101833. <https://doi.org/10.1016/j.irfa.2021.101833#>
- Kim, J. H. (2016). A study on the effect of financial inclusion on the relationship between income inequality and economic growth. *Emerging Markets Finance and Trade*, 52(2), 498–512. <https://doi.org/10.1080/1540496X.2016.1110467>
- Kimber, A. (2023). How to champion equality and career progression for women in fintech. *EY*.
- Klapper, L., El-Zoghbi, M., & Hess, J. (2016). *Achieving the sustainable development goals: The role of financial inclusion*. CGAP. <http://www.cgap.org>
- Komürçüoğlu, Ö. F., & Komürçüoğlu, E. D. (2025). The impact of fintech on gender inequality in the labour market: Novel evidence from Turkey. *Gender Issues*, 42(1), 11. <https://doi.org/10.1007/s12147-025-09355-x>
- Kumar, N. (2013). Financial inclusion and its determinants: Evidence from India. *Journal of Financial Economic Policy*, 5(1), 4–19. <https://doi.org/10.1108/17576381311317754>
- Fu, X., Ghauri, P., & Lu, J. (2025). Digital technology and inclusive development during global crisis: Evidence from a randomised experiment in Bangladesh. *Research Policy*, 54(3), 105173. <https://doi.org/10.1016/j.respol.2022.104701>
- Lashitew, A. A., Van Tulder, R., & Liasse, Y. (2019). Mobile phones for financial inclusion: What explains the diffusion of mobile money innovations?. *Research Policy*, 48(5), 1201-1215. <https://doi.org/10.1016/j.respol.2018.12.010>
- Loko, M. B., & Yang, Y. (2022). *Fintech, female employment, and gender inequality*. International Monetary Fund.
- Lotto, J. (2018). Examination of the status of financial inclusion and its determinants in Tanzania. *Sustainability*, 10(8), 2873. <https://doi.org/10.3390/su10082873>
- Lui, A., & Lamb, G. W. (2018). Artificial intelligence and augmented intelligence collaboration: Regaining trust and confidence in the financial sector. *Information & Communications Technology Law*, 27(3), 267–283. <https://doi.org/10.1080/13600834.2018.1488659>
- Mader, P. (2013). Rise and fall of microfinance in India: The Andhra Pradesh crisis in perspective. *Strategic Change*, 22(1–2), 47–66. <https://doi.org/10.1002/jsc.1921>
- Makina, D. (2019). The potential of fintech in enabling financial inclusion. In *Extending financial inclusion in Africa*, 33(1), 299–318. Elsevier. <https://doi.org/10.1016/B978-0-12-814164-9.00014-1>
- Mbiti, I., & Weil, D. N. (2015). Mobile banking: The impact of M-PESA in Kenya. In *African successes, Volume III: Modernization and development*, 12(3), 247–293. University of Chicago. <https://doi.org/10.7208/9780226315867-009>
- Merton, R. C., & Bodie, Z. (1995). A conceptual framework for analyzing the financial system. In *The global financial*

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

system: A functional perspective 12(6), 3–31. Harvard Business School Press.

Morawczynski, O. (2009). Exploring the usage and impact of “transformational” mobile financial services: The case of M-PESA in Kenya. *Journal of Eastern African Studies*, 3(3), 509–525. <https://doi.org/10.1080/17531050903273768>

Morgan, P. J. (2022). Fintech and financial inclusion in Southeast Asia and India. *Asian Economic Policy Review*, 17(2), 183–208. <https://doi.org/10.1111/aepr.12379>

Morgan, P. J., & Trinh, L. Q. (2019). Determinants and impacts of financial literacy in Cambodia and Viet Nam. *Journal of Risk and Financial Management*, 12(1), 19. <https://doi.org/10.3390/jrfm12010019>

Morsy, H. (2020). Access to finance—mind the gender gap. *The Quarterly Review of Economics and Finance*, 78, 12–21. <https://doi.org/10.1016/j.qref.2020.02.005>

Mukhopadhyay, J. P. (2016). Financial inclusion in India: A demand-side approach. *Economic and Political Weekly*, 51(12), 46–54. <http://www.jstor.org/stable/44165933>

Neaime, S., & Gaysset, I. (2018). Financial inclusion and stability in MENA: Evidence from poverty and inequality. *Finance Research Letters*, 24, 230–237. <https://doi.org/10.1016/j.frl.2017.09.007>

Neaime, S., & Gaysset, I. (2024). Financial inclusion, integration, and stability asymmetries in the Mediterranean region. *The Journal of Economic Asymmetries*, 30, e00386. <https://doi.org/10.1016/j.jeca.2024.e00386>

Ohiomu, S., & Ogbeide-Osaretin, E. N. (2019). Financial inclusion and gender inequality reduction: Evidence from Sub-Saharan Africa. *The Indian Economic Journal*, 67(3), 367–372. <https://doi.org/10.1177/0019466220946411>

Ouma, S. A., Odongo, T. M., & Were, M. (2017). Mobile financial services and financial inclusion: Is it a boon for savings mobilization? *Review of Development Finance*, 7(1), 29–35. <https://doi.org/10.1016/j.rdf.2017.01.001>

Ozili, P. K. (2021). Big data and artificial intelligence for financial inclusion: Benefits and issues. In *Artificial intelligence, fintech, and financial inclusion* 16(2), 1–10. <https://doi.org/10.2139/ssrn.3766097>

Packin, N. G., & Lev-Aretz, Y. (2018). Learning algorithms and discrimination. In *Research handbook on the law of artificial intelligence*, 24(3), 88–113. <https://doi.org/10.4337/9781786439055.00014>

Pahlevan Sharif, S., Naghavi, N., Waheed, H., & Ehigiamusoe, K. U. (2023). The role of education in filling the gender gap in financial inclusion in low-income economies. *International Journal of Emerging Markets*, 18(12), 5755–5777. <https://doi.org/10.1108/IJOEM-07-2021-0991>

Pal, A., Herath, T., & Rao, H. R. (2021). Why do people use mobile payment technologies and why would they continue? An examination and implications from India. *Research Policy*, 50(6), 104228. <https://doi.org/10.1016/j.respol.2021.104228>

Peng, W., & Zhu, F. (2021). Trust building and credit reporting with big data in the digital age. In *The Palgrave handbook of technological finance* 12(6), 809–836. https://doi.org/10.1007/978-3-030-65117-6_29

Pereira da Silva, A., Frost, J., & Gambacorta, L. (2019). *Welfare implications of digital financial innovation* (BIS Working Papers No. 793). Bank for International Settlements.

Philippon, T. (2019). *On fintech and financial inclusion* (NBER Working Paper No. 26330). <https://doi.org/10.3386/w26330>

Piketty, T. (2014). Capital in the twenty-first century. *Science*, 344(6186), 838–843. <https://doi.org/10.1126/science.1251345>

Porto, G., & Conti, B. (2022). Trade and inequality in developing countries: A review of recent evidence. *Journal of International Economics*, 137, 103606. <https://doi.org/10.1016/j.jinteco.2022.103606>

Purda, L., & Ying, C. (2022). Consumer credit assessments in the age of big data. In *Big data in finance: Opportunities and challenges of financial digitalization* 25(1), 95–113. https://doi.org/10.1007/978-3-031-12240-8_6

Rao, S. (2015). *Gender and financial inclusion through the post*. Universal Postal Union & United Nations Women.

Riddell, W. C., & Song, X. (2011). The impact of education on unemployment incidence and re-employment success: Evidence from the US labour market. *Labour Economics*, 18(4), 453–463. <https://doi.org/10.1016/j.labeco.2011.01.003>

Sadok, H., Sakka, F., & El Maknoui, M. E. H. (2022). Artificial intelligence and bank credit analysis: A review. *Cogent Economics & Finance*, 10(1), 2023262. <https://doi.org/10.1080/23322039.2021.2023262>

Sarma, M. (2016). Measuring financial inclusion using multidimensional data. *World Economics*, 17(1), 15–40.

Seguino, S. (2000). Gender inequality and economic growth: A cross-country analysis. *World Development*, 28(7), 1211–1230. [https://doi.org/10.1016/S0305-750X\(00\)00018-8](https://doi.org/10.1016/S0305-750X(00)00018-8)

Seth, S. (2009). Inequality, interactions, and human development. *Journal of Human Development and Capabilities*,

- 10(3), 375–396. <https://doi.org/10.1080/19452820903048878>
- Sethy, S. K. (2015). Developing a financial inclusion index and inclusive growth in India: Issues and challenges. *The Indian Economic Journal*, 63(3), 283–311.
- Song, Z., Rehman, S. U., PingNg, C., Zhou, Y., Washington, P., & Verschueren, R. (2024). Do fintech algorithms reduce gender inequality in bank loans? A quantitative study from the USA. *Journal of Applied Economics*, 27(1), 2324247. <https://doi.org/10.1080/15140326.2024.2324247>
- Sparks, A., & Eckenrode, J. (2020). *Achieving gender equity in the fintech community*.
- Späth, J., & Schmid, K. D. (2018). The distribution of household savings in Germany. *Jahrbücher für Nationalökonomie und Statistik*, 238(1), 3–32. <https://doi.org/10.1515/jbnst-2017-0120>
- Swamy, V. (2014). Financial inclusion, gender dimension, and economic impact on poor households. *World Development*, 56, 1–15. <https://doi.org/10.1016/j.worlddev.2013.10.019>
- Tang, C. S. (2022). Innovative technology and operations for alleviating poverty through women's economic empowerment. *Production and Operations Management*, 31(1), 32–45. <https://doi.org/10.1111/poms.13349>
- Tchamyou, V. S., Erreygers, G., & Cassimon, D. (2019). Inequality, ICT and financial access in Africa. *Technological Forecasting and Social Change*, 139, 169–184. <https://doi.org/10.1016/j.techfore.2018.11.004>
- Tian, L., & Kling, G. (2021). Financial inclusion and financial technology: Finance for everyone? *The European Journal of Finance*, 28(1), 1–2. <https://doi.org/10.1080/1351847X.2021.1981418>
- Tchidi, G. E., & Zhang, W. (2025). Mediating effect of financial inclusion on FinTech innovations and economic development in West Africa: Evidence from the Benin Republic. *International Journal of Finance & Economics*, 30(2), 1032–1048. <https://doi.org/10.1002/ijfe.2954>
- Tok, Y. W., & Heng, D. (2022). *Fintech: Financial inclusion or exclusion?* International Monetary Fund.
- Tripathi, R., Yadav, N., & Shastri, R. K. (2016). Financial inclusion in India through Pradhan Mantri Jan Dhan Yojana: An empirical analysis of statistical evidence. *Indian Journal of Finance*, 10(10), 42–55. <https://doi.org/10.17010/ijf/2016/v10i10/103014>
- Tripathi, S., & Rajeev, M. (2023). Gender-inclusive development through fintech: Studying gender-based digital financial inclusion in a cross-country setting. *Sustainability*, 15(13), 10253. <https://doi.org/10.3390/su151310253>
- Yeyoumo, A. K., Asongu, S. A., & Agyemang-Mintah, P. (2023). Fintechs and the financial inclusion gender gap in Sub-Saharan African countries. *Women's Studies International Forum*, 97, 102695. <https://doi.org/10.1016/j.wsif.2023.102695>
- Yorulmaz, R. (2013). Construction of a regional financial inclusion index in Turkey. *BDDK Bankacılık ve Finansal Piyasalar Dergisi*, 7(1), 79–101.

Tables and Figures

Table 1: Variables , sources and definitions

Variable	Source	Definition
Panel A : Dependent Variable		
GII	United Nations Development Programme	Gender Inequality Index
Panel B : Financial inclusion Indicators		
Account	Global Findex	Having an account at a formal financial institution (%age 15+)
Saving	Global Findex	Saving at a formal financial institution (% age 15+)
Borrowing	Global Findex	Borrowing from a formal financial institution (% age15+)
Panel C: Fintech Indicators		
Fintech	Global Findex	Mobile phone used to pay bills (Females % age 15+)
Panel E: Control Variables		
Education	World development indicators (World Bank)	School enrolment, secondary (% gross
Redistributive Policies	World development indicators (World Bank)	General government final consumption expenditure(% of GDP
Trade	World development indicators (World Bank)	Trade (% of GDP)
Population Growth	World development indicators (World Bank)	Population growth (annual %)
GDP	World development indicators (World Bank)	GDP (constant 2015 US\$)
Institutional Quality	World Governance indicators(WGI) (World Bank)	Author's calculation: adding the WGI components

Table 2: Variables' Summary Statistics

Variable	Observations	Mean	Median	Min	Max
GII	318	0.38	0.37	0.02	0.82
Fintech	318	0.04	0.00	0.00	0.35
Account	318	0.45	0.39	0.00	1.00
Saving	318	0.13	0.10	0.00	0.65
Borrowing	318	0.13	0.11	0.00	0.48
Institutional Quality	318	-1.83	-2.44	-11.13	11.12
GDP Growth	318	3.20	3.54	-7.38	11.65
Trade	318	76.38	69.40	-0.04	166.57
Population Growth	318	1.36	1.42	-2.22	4.68
Education	318	76.60	84.76	12.69	135.90
Redistributive Policies	318	14.54	14.15	4.21	28.48
GDP (in Billions\$)	318	116.50	41.01	0.83	781.70

Table 3: Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)Fintech	1											
(2)Borrowing	0.644***	1										
(3)Saving	0.578***	0.757***	1									
(4)Account	0.503***	0.678***	0.821***	1								
(5)Institutional Quality	0.406***	0.609***	0.796***	0.749***	1							
(6)GDP growth	-0.316***	-0.261***	-0.207***	-0.350***	-0.195***	1						
(7)Trade	0.032	0.088	0.185***	0.209***	0.262***	0.031	1					
(8)Population growth	-0.221***	-0.280***	-0.249***	-0.450***	-0.316***	0.317***	-0.094	1				
(9)Education	0.374***	0.551***	0.603***	0.749***	0.677***	-0.235***	0.145**	-0.503***	1			
(10)Redisributive policies	0.247***	0.262***	0.366***	0.409***	0.468***	-0.351***	0.051	-0.320***	0.402***	1		
(11)GDP	0.333***	0.294***	0.328***	0.252***	0.199***	-0.049	-0.188***	-0.117*	0.151**	0.066	1	
(12)GII	-0.176**	-0.368***	-0.446***	-0.597***	-0.526***	0.247***	-0.219***	0.423***	-0.554***	-0.264***	-0.129*	1

Computed correlation used pearson-method with listwise-deletion
 Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 4: t-test on the difference in Fintech adoption and Financial inclusion between males and females

Variable	Female	Male	p value
Fintech	0.122	0.137	0.308
Account	0.564	0.619	0.005 ***
Saving	0.218	0.253	0.005 ***
Borrowing	0.195	0.228	0.004 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 5: t-test on the gender inequality gap

Gap	Mean	95%Confidence	t-statistics	p-value
GII (Gender Inequality Index)	0.377	0.319 - 0.355	37.71	0.000***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 6: Impact of Fintech on Financial Inclusion

Variable	(1) Account	(2) Savings	(3) Borrowing
Fintech	0.134 *** (0.028)	0.270 *** (0.034)	0.428 *** (0.056)
Government Institutional Quality	0.379 *** (0.052)	0.614 *** (0.052)	0.344 *** (0.064)
GDP growth	-0.134 *** (0.028)	0.000 (0.027)	-0.046 (0.032)
Trade	0.066 * (0.032)	0.029 (0.031)	-0.026 (0.049)
Population growth	-0.067 . (0.035)	0.068 * (0.034)	0.003 (0.036)
Education	0.367 *** (0.039)	0.107 ** (0.039)	0.182 *** (0.045)
Redisributive policies	-0.026 (0.045)	-0.018 (0.029)	-0.095 ** (0.034)
GDP	0.076 ** (0.025)	0.114 *** (0.029)	0.055 (0.041)
Adjusted R-squared	0.719	0.721	0.575
p-value	0.000	0.000	0.000

Robust Standard errors in parentheses

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 7: Impact of Fintech and Financial Inclusion on gender inequality (GII)

Variable	(1)GII	(2)GII	(3)GII	(4)GII	(5)GII
Fintech	-0.035 *** (0.011)	0.029 * (0.011)	0.038 *** (0.011)	0.035 ** (0.011)	0.034 ** (0.012)
Account			-0.067 *** (0.016)		
Saving				-0.021 (0.017)	
Borrowing					-0.012 (0.012)
Government Institutional Quality		-0.060 *** (0.014)	-0.035 * (0.015)	-0.047 * (0.019)	-0.056 *** (0.015)
GDP growth		0.027 * (0.011)	0.018 . (0.011)	0.027 * (0.011)	0.027 * (0.011)
Trade		-0.022 * (0.010)	-0.017 . (0.009)	-0.021 * (0.010)	-0.022 * (0.010)
Population growth		0.036 ** (0.011)	0.031 ** (0.011)	0.037 *** (0.011)	0.036 ** (0.011)
Education		-0.058 *** (0.013)	-0.033 * (0.014)	-0.055 *** (0.014)	-0.055 *** (0.014)
Redisributive policies		0.014 (0.014)	0.012 (0.012)	0.014 (0.014)	0.013 (0.014)
GDP		-0.014 * (0.007)	-0.009 (0.007)	-0.012 . (0.007)	-0.014 * (0.007)
Adjusted R-squared:	0.028	0.398	0.428	0.400	0.398
p-value	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 8: Impact of Fintech and Financial Inclusion on gender inequality(GII) : a quartile Analysis

	(1)GII	(2)GII	(3)GII	(4)GII	(5)GII	(6)GII	(7)GII	(8)GII	(9)GII	(10)GII	(11)GII	(12)GII	(13)GII	(14)GII	(15)GII
Variable	10%	25%	50%	75%	90%	10%	25%	50%	75%	90%	10%	25%	50%	75%	90%
Fintech	-0.003 (0.009)	0.001 (0.010)	0.012 (0.014)	0.080 *** (0.022)	0.090 *** (0.023)	-0.002 (0.010)	0.004 (0.013)	0.019 (0.016)	0.083 *** (0.023)	0.113 *** (0.023)	-0.002 (0.010)	0.001 (0.013)	0.019 (0.017)	0.077 *** (0.024)	0.111 *** (0.025)
Account	-0.079 *** (0.025)	-0.111 *** (0.019)	-0.085 *** (0.023)	-0.038 * (0.020)	-0.041 * (0.018)										
Saving						-0.036 (0.021)	-0.021 (0.028)	-0.011 (0.022)	-0.025 (0.020)	-0.045 . (0.019)					
Borrowing											-0.006 (0.012)	-0.001 (0.016)	0.002 (0.018)	-0.009 (0.018)	-0.030 . (0.018)
Government Institutional Quality	-0.011 (0.018)	-0.002 (0.017)	-0.031 (0.021)	-0.076 *** (0.020)	-0.068 *** (0.020)	-0.021 (0.022)	-0.029 (0.030)	-0.070 * (0.028)	-0.075 ** (0.024)	-0.071 ** (0.022)	-0.037 * (0.017)	-0.051 * (0.021)	-0.073 ** (0.023)	-0.088 *** (0.020)	-0.057 ** (0.022)
GDP growth	0.020 * (0.010)	0.012 (0.013)	0.010 (0.018)	0.024 (0.018)	0.011 (0.016)	0.028 ** (0.010)	0.025 . (0.015)	0.030 (0.022)	0.034 . (0.018)	0.019 (0.017)	0.029 ** (0.010)	0.023 (0.014)	0.026 (0.022)	0.028 (0.018)	0.028 (0.017)
Trade	0.000 (0.010)	-0.010 (0.010)	-0.015 (0.011)	-0.024 * (0.010)	-0.034 *** (0.010)	-0.018 (0.011)	-0.018 (0.012)	-0.023 * (0.011)	-0.026 ** (0.010)	-0.033 *** (0.009)	-0.017 (0.011)	-0.018 (0.013)	-0.025 * (0.011)	-0.026 * (0.010)	-0.039 *** (0.009)
Population growth	0.010 (0.017)	0.020 (0.013)	0.051 *** (0.019)	0.048 *** (0.017)	0.046 ** (0.014)	0.021 (0.018)	0.037 * (0.017)	0.049 ** (0.017)	0.048 ** (0.016)	0.046 ** (0.014)	0.017 (0.018)	0.031 . (0.016)	0.045 ** (0.017)	0.046 ** (0.016)	0.047 *** (0.013)
Education	0.012 (0.019)	-0.028 (0.018)	-0.033 . (0.018)	-0.036 . (0.019)	-0.023 (0.019)	0.007 (0.021)	-0.038 . (0.023)	-0.058 ** (0.018)	-0.048 ** (0.018)	-0.044 ** (0.017)	-0.002 (0.021)	-0.038 (0.023)	-0.064 *** (0.019)	-0.049 ** (0.017)	-0.048 ** (0.016)
Redistributive policies	0.008 (0.022)	0.014 (0.021)	0.002 (0.020)	0.019 (0.013)	0.019 . (0.010)	0.005 (0.023)	-0.001 (0.029)	-0.004 (0.024)	0.022 (0.015)	0.018 . (0.010)	-0.002 (0.024)	-0.004 (0.029)	-0.008 (0.025)	0.024 . (0.014)	0.011 (0.012)
GDP	0.019 *** (0.007)	0.012 (0.008)	0.002 (0.009)	-0.032 * (0.013)	-0.014 (0.019)	0.013 (0.008)	-0.002 (0.011)	-0.009 (0.011)	-0.033 ** (0.013)	-0.008 (0.021)	0.007 (0.008)	-0.006 (0.012)	-0.012 (0.011)	-0.032 * (0.013)	-0.019 (0.019)
Pseudo R-squared	17.70%	28.30%	34.20%	28.00%	20.60%	14.60%	23.8%	32.00%	28.00%	20.9%	13.40%	23.20%	31.70%	27.8%	20.40%
p-value	0.000	0.007	0.007	0.007	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 9: Wu-Hausman test of FinTech and Financial Inclusion endogeneity

Endogenous Variable	(1) Account	(2) Savings	(3) Borrowing
FinTech	0.999	1.000	0.999
Financial Inclusion	0.994	1.000	0.992

Table 10: Impact of Fintech , Financial Inclusion on Gender Inequality: Machine learning models’ selection based on goodness of fit R^2

Model	(1) Accounts	(2) Savings	(3) Borrowing	(4) All FI Components
Extra Trees Regressor (ET)	27.90%	28.00%	26.30%	28.24%
Random Forest Regressor (RF)	25.07%	21.35%	21.21%	23.87%
Bayesian Ridge(BR)	25.79%	24.20%	22.55%	24.75%
K Neighbors Regressor (KNN)	24.55%	28.00%	23.54%	26.18%
Huber Regressor(HR)	21.17%	18.37%	16.16%	17.19%
Gradient Boosting Regressor(GBR)	8.13%	2.08%	2.00%	11.08%
Ridge Regression(Ridge)	24.54%	22.29%	20.45%	22.16%
AdaBoost Regressor(ADA)	19.82%	14.50%	17.69%	18.03%
Least Angle Regression(LAR)	24.44%	22.16%	20.29%	21.95%
Extreme Gradient Boosting(Xgboost)	3.96%	0.20%	2.00%	7.09%

Figure 1: Gender Inequality according to country-level income group

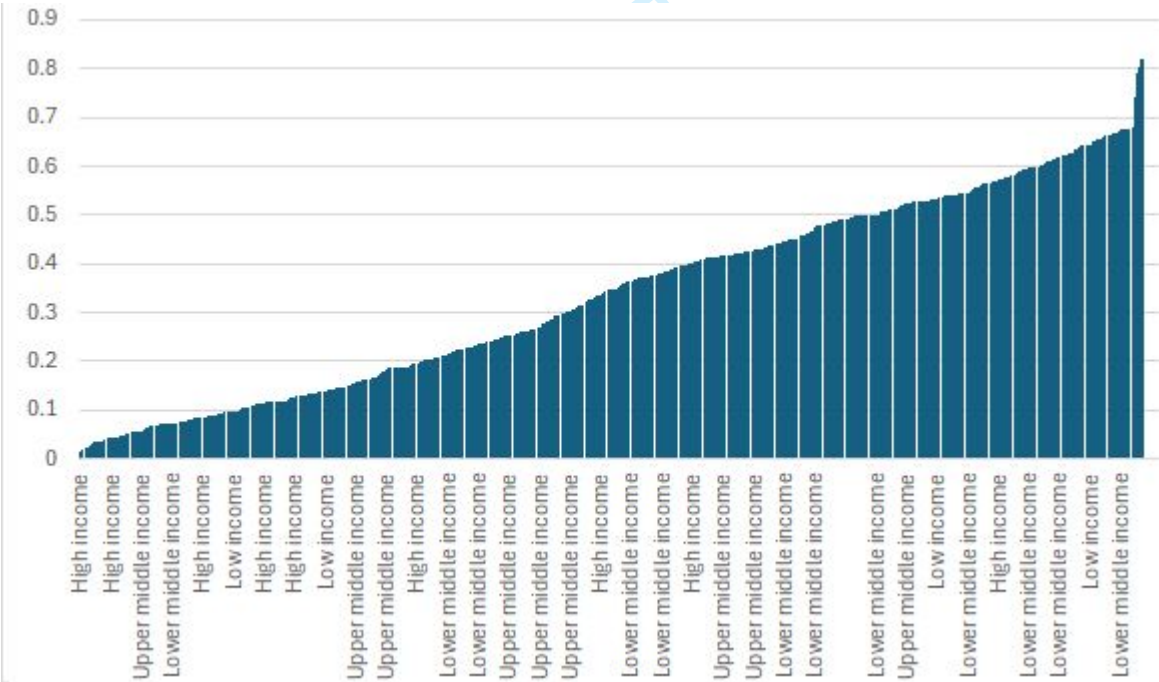


Figure 2: Gender Inequality, according to regional income group

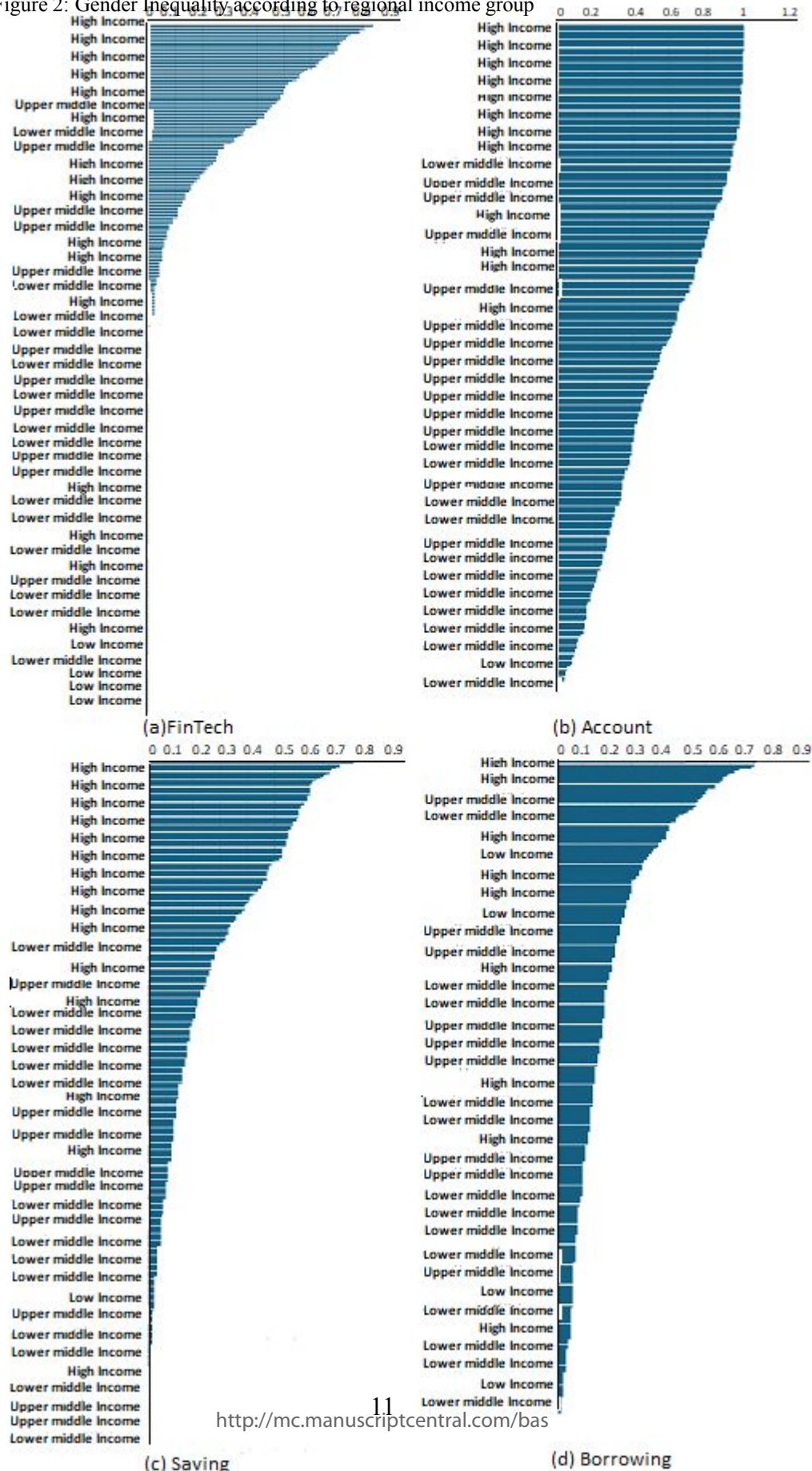


Figure 3: Variables’ Importance and Features’ selection : Impact of Fintech and Finan

