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Women in Fintech:

As Leaders and Users

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Women in Fintech: As Leaders and Users

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ABSTRACT: While digital financial services have made access to finance easier, faster, and less costly, helping to broaden digital financial inclusion, its impact on gender gaps varies across countries. Moreover, women leaders in the fintech industry, although growing, remain scarce. This paper explores the interaction between 'women' and 'fintech' by examining: (i) the role of women leaders on firm-level performance in the fintech industry; and (ii) the determinants of gender gaps in the usage of digital services to better understand the cross-country differences. Results indicate that greater gender diversity in the executive board is associated with better performance of fintech firms. With regard to determinants of the gender gaps in the usage of digital financial services, we find that higher financial and digital literacy of women is associated with lower gender gaps in digital financial inclusion, and that socio-cultural factors also play a key role.

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WORKING PAPERS

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Section 1: Introduction

Reliance on technology and adoption of digital financial services (DFSs), like using the mobile phone and internet to conduct financial transactions, has progressed in the past decade, and accelerated during the COVID-19 crisis. Access to such financial technology, or fintech, has been particularly helpful in advancing the goals of financial inclusion by bringing in individuals, households, and businesses into the system, who were otherwise left out of the traditional financial sector.

Gender gaps in financial inclusion, however, continue to persist. Globally, 65 percent of women have an account, lagging that of men at 72 percent (Demirgüç-Kunt et al., 2018). Barriers such as distance to the nearest bank, insufficient documents for opening a bank account, or socio-economic and cultural factors have hindered women from accessing financial institutions (Murata and Sioson, 2018). Financial technologies can help overcome some of these obstacles and financially empower women as ease of usage and accessibility increase (Sioson and Kim, 2019). In fact, financial inclusion indices developed by Sahay et al. (2020) suggest that DFSs have indeed helped narrow gender gaps in several countries, but disparities across regions and countries remain large. Studying why such differences exist is important not only for closing the gender gaps in financial inclusion but also from a macroeconomic standpoint as greater digital financial inclusion is found to be positively associated with economic growth, which benefits society (Khera et al., 2021).

Apart from gender gaps in the usage of DFSs, the economic relevance of the role of women as leaders in the financial industry is also strong. Women hold less than 25 percent of board seats in banks and bank supervision agencies and account for about 5 percent of bank CEOs globally (Sahay et al., 2022). A recent study by OMFIF[1] confirms these trends in gender gaps for the financial sector more broadly, specifically looking at central banks, sovereign wealth funds, and pension funds. This is shown to have economic and financial implications – for instance, Sahay and Cihak (2018) find that greater shares of women on bank boards and banking supervision boards are associated with greater bank stability. Given the increasingly important role played by fintech firms in the finance industry, examining the role of women as leaders in the fintech industry becomes important. Female leaders in the fintech industry could be pivotal in developing, marketing, and supplying financial products that may better suit women's needs[2] – which may further help in bridging the gender gap in digital financial inclusion.

In this paper, we focus on the interaction between gender and fintech and examine gender gaps in leadership in the fintech industry and as users of DFSs (i.e., digital financial inclusion). This paper contributes to the existing literature in three areas. First, using a novel database on fintech firm-level leadership across 97 countries, our work comprehensively quantifies gender gaps in leadership positions in the fintech industry. Second, we expand the existing knowledge on the impact of having women leaders in the financial sector by further examining this question in the still nascent fintech industry. Third, we contribute to the existing study on drivers of financial inclusion by exploring factors associated with gender gaps in digital financial inclusion. To our knowledge, this is the first paper to examine these questions focused on the fintech industry and its impact on gender gaps in financial inclusion.

[1] https://www.omfif.org/gbi2021/

[2] https://www.centerforfinancialinclusion.org/including-women-customers-in-inclusive-fintech

There are three key findings of this paper. First, we find that there are large gender gaps in leadership positions in the fintech industry. Women represent less than 10 percent of leadership—both as founders and as members of executive boards of fintech firms. While the share of women leaders has been steadily improving over time—mostly as improved representation in newer firms—large gender gaps continue to persist. In fact, the share of women in leadership position is even lower than those in the traditional banking industry and technology companies. There is considerable regional variation in firms founded by women, with countries in the Western Hemisphere, Asia and the Pacific, and Europe having the highest share of companies founded by women, while the Middle East and Central Asia have the lowest.

Second, we find a positive relationship between having more women on executive boards and the revenue earned by the respective fintech firm as well as the funding that they receive for future investments. A 10 percent higher share of women on executive boards is associated with roughly 13 percent higher revenue and funding earned by a firm. In contrast, we find that the firms founded by women tend to make less revenue and receive less funding compared to the firms founded by men. While we do not have the data to test the mechanisms, prior literature (Chamess and Gneezy, 2012, Greenberg and Mollick, 2015, Ewens and Townsend, 2020) suggests that the weaker performance of women-founded firms could be interpreted as reflecting higher risk aversion of women in investment decisions and gender bias of investors (who are majority men) funding the firms.

Third, we find that gender gaps in the usage of digital financial services across countries are associated with gender gaps in financial literacy, digital literacy, and socio-cultural factors. Using gender gaps in a composite measure of digital financial inclusion, we estimate a random effect panel data model using data on emerging and developing economies over two time periods. We find that countries with a higher share of women graduating in Science, Technology, Engineering, and Mathematics (STEM) and with lower gender gaps in upper secondary education tend to have lower gender gaps in digital financial inclusion.

These results highlight the policy relevance for greater investment in the digital and financial literacy of women including for those who are left out of the education system. Furthermore, a sustained effort in increasing the representation of women in STEM-related fields and devising policies that reduce barriers to supporting women entrepreneurs in the fintech industry or increasing their representation on the boards of fintech firms would have economic benefits for society.

The remainder of the paper is structured as follows: In Section 2 we discuss stylized facts about women leaders in the fintech industry and explore the relationship between firm performance and the gender of the founder and gender diversity in the executive board of firms in this industry. In Section 3, we look at the gender gap in the usage of digital financial services and explore the factors associated with digital financial inclusion. Lastly, in Section 4, we suggest some policy measures to tackle gender gaps in digital financial inclusion during and post COVID-19 and conclude.

Section 2: Gender Gaps in Fintech Leadership

In this section, we document the state of women's leadership in the fintech industry and ask if there are economic benefits from greater gender diversity. It adds to an existing body of literature that looks at the firm-level performance of financial and non-financial firms: D'espallier, Guérin, and Mersland (2011) analyze data from 350 micro finance institutions across 70 countries and find that lending to more women was associated

with lower write-offs and lower portfolio-at-risk. Gender diversity on the boards of non-financial and financial firms is also positively correlated with the financial performance of firms (Hunt, Layton and Prince, 2015), performance of share prices (Credit Suisse, 2012) and the return on sales (Catalyst, 2011). Another study on firms in finance and investment finds that female-led firms are more likely to reinvest, create jobs and have higher levels of innovation than their male counterparts.[3]

A. Data Source and Firm Characteristics

To explore gender gaps in leadership in the fintech industry, we combine unique firm-level data across 97 countries from Crunchbase on information on fintech firms and information on founders, executive board members and other employees.[4]

The database consists of two parts:
(i) Descriptive information for over 12,000 fintech firms – including their size (number of employees and revenue range), location, year of establishment and information on funding the firm received in the most recent round. The data includes firms established between 1690 and 2020.
(ii) Details on the founders, executive board members and other employees – including their gender and education background - for about 28,000 individuals in 9922 firms established until 2020.

Combining (i) and (ii) results in 5,256 firms with a total of 14,000 individuals in 83 countries. This data provides a snapshot of currently existing firms and their latest firm performance indicators. We do not observe their historical data, and therefore cannot observe the trajectory of the changing board diversity or firm performance over time.[5]

The vast majority of the fintech companies are less than 10 years old and concentrated in North America and Europe. Roughly 75 percent of the firms are small, with less than 50 employees, while those with more than 250 employees account for less than 8 percent. We discuss the distribution of these firms by region, size, revenue stream and funding earned, and the industry specifications in greater detail in Appendix A.

B. Gender Gaps in Leadership

We find significant gender gaps in leadership and entrepreneurship in the fintech industry, measured by the following two indicators: (i) the share of firms founded by women; and (ii) the share of women executives in the firm board.

The average share of firms with women founders has hovered around 10-15 percent over the last 20 years (Figure 1). A higher share of the younger firms – that have been established in the last 10 years – have a woman founder as compared to older firms. Regional differences are relatively small, with around 11-14

[3] https://hbr.org/2013/09/global-rise-of-female-entrepreneurs

[4] Crunchbase gets their data from reports submitted by their investors, which are thereafter verified by machine learning algorithms and their data analytics team. More information can be found on: https://support.crunchbase.com/hc/en-us/articles/360009616013-Where-does-Crunchbase-get-their-data-

[5] While the database includes some firms that have been closed, almost 99 percent of the firms in our sample are active and our results could therefore suffer from selection bias.

percent of firms founded by women in countries across the Western Hemisphere, Asia and the Pacific, Africa, and Europe. On the other hand, the Middle East and Central Asia region have the lowest fraction of such firms at 8 percent (Figure 2).

Share of Women Founders

Figure 1. Number of Firms Founded by Women

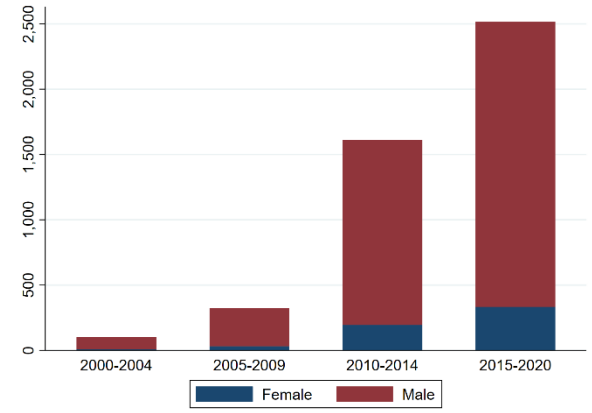
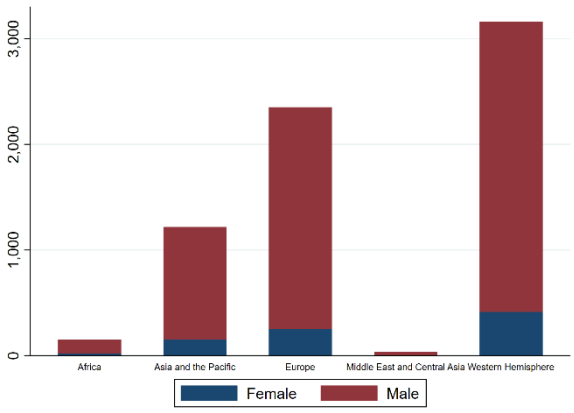


Figure 2. Number of Firms by Region



Sources: Authors' calculation based on Crunchbase data

As of September 2020, the share of women executives in all fintech firms in the sample was around 7 percent. Women's representation on executive boards in fintech firms is comparatively low both relative to the share of women in executive boards of technology firms—which is around 14.5 percent[6]—and in banks and banking supervision agencies—which is 23 percent and 33 percent respectively.[7]

The share of women on the executive board is slightly higher at more recently founded firms (Figure 3). Looking at the moving average[8] of the share of women on executive boards[9] based on the year in which the firm was founded, the share increases to 7 percent on average for all firms cumulatively that are established until 2020, compared to less than 6 percent on average for only the firms that were established before 2000 . This increase, while welcome, is slow-moving and not large.

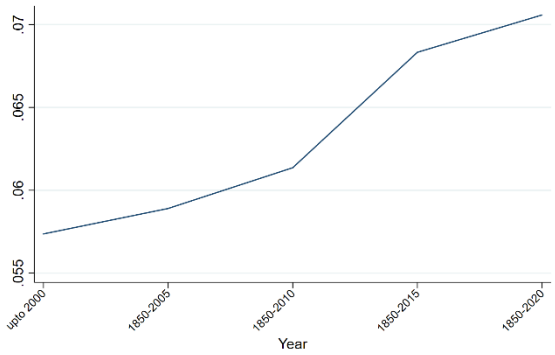
[6] Recent work by S&P Global (accessed at: https://www.spglobal.com/en/research-insights/featured/the-changing-face-of-tech on 10/10/2020) uses data on 1,280 technology companies, for which they examined detailed people data for 2010 to February 2020. They find that currently, for the U.S., the share of women on boards of tech companies stands at 21.5 percent, while for the re st of the world it is 14.5 percent.

[7] Sahay and Cihak (2018) use data on women on board in banks and banking supervision agencies.

[8] Since the raw data is noisy and it is hard to discern any pattern on a year-on-year basis.

[9] For the graphs in which we look at share of women in executive boards (Figures 3, 4, 6, and 8), we consider only firms that are up to 95th percentile in terms of fraction of women in the executive board, to eliminate outliers.

Figure 3. Average Fraction of Women on Executive Boards, by Time Period



Next, we look at if the share of women entrepreneurs in the fintech industry is related to the size of the firm. We find that the share of women in the executive board tends to be higher at larger firms, both in terms of the revenue that the firm earns and the number of employees (Figures 4 and 6). Among the firms which have revenue less than $10 million, the average share of women executives is 9 percent, compared to 14 percent for firms with revenue between $10 million and $100 million, and larger than $100 million. Similar distribution follows if we look at the average share of women executives by firm size in terms of the number of employees. Women account for 8 percent of executive board members of firms with employees less than 50, compared to an average of 11 percent and 13.5 percent for firms with 51-250 and more than 250 employees, respectively.

In contrast to the share of women on executive boards that rise with the size of the firm, the share of women-founded firms tends to fall as firm size increases (Figures 5 and 7). Of all the firms that earn a revenue of less than $10 million, 14 percent of them are founded by women which goes down to 7 percent for firms that earn more than $100 million. There is a similar trend with firm performances in terms of funding. Figures 8 and 9 show that there is a positive correlation between the share of women on executive boards and the funding received by the firms, while firms founded by women tend to get lower funding.

Representation of Women and Firm Characteristics

Figure 4. Share of Women in Executive Boards, by Revenue Group

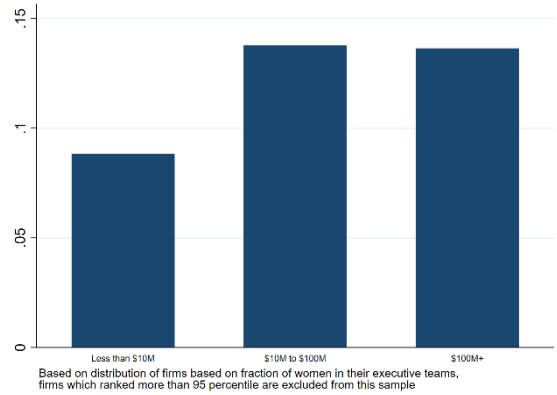


Figure 5. Share of Firms Founded by Women, by Revenue Group

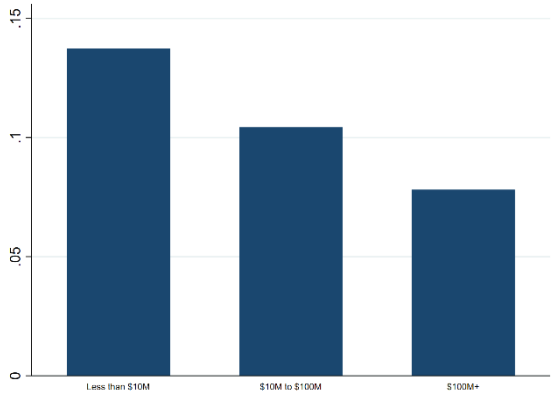
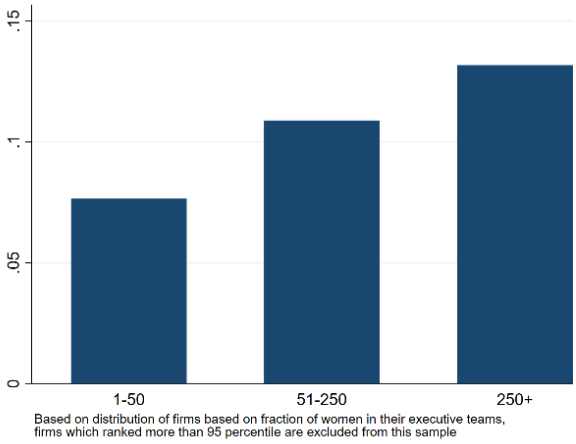


Figure 6. Share of Women in Executive Boards, by Size



Based on distribution of firms based on fraction of women in their executive teams, firms which ranked more than 95 percentile are excluded from this sample

Figure 7. Share of Firms Founded by Women, by Size

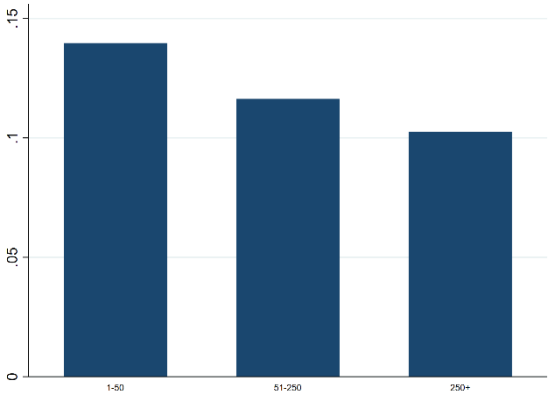
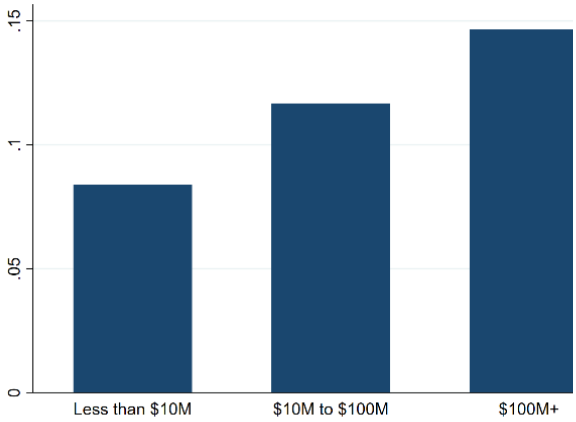
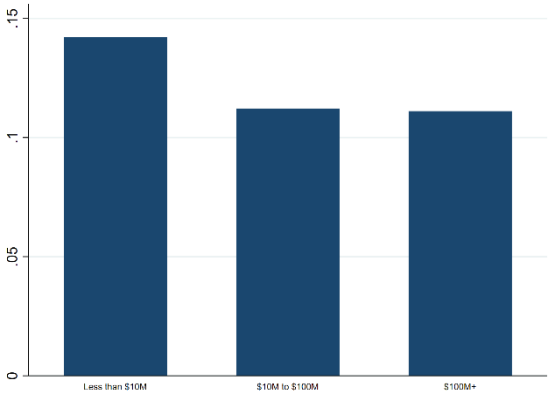


Figure 8. Share of Women in Executive Boards, by Funding Range



Based on distribution of firms based on fraction of women in their executive teams, firms which ranked more than 95 percentile are excluded from this sample

Figure 9. Share of Firms Founded by Women, by Funding Range



Sources: Authors' calculation based on Crunchbase data

C. Gender Gaps in Leadership and Firm performance

The key research question we ask in this section is: what is the impact of female entrepreneurship on firm performance in the fintech industry? To analyze this, we would ideally want a random assignment of women/men as founders or in executive boards and assess the performance of the respective fintech firm over time. In the absence of such experimental or quasi-experimental data at the cross-country level, we rely on a simple OLS regression to understand if there is an association between the share of women leadership positions and fintech firm performance. We use two metrics to proxy a firm's performance that are consistently available across firms. First, we consider the revenue earned by the firms (as a proxy of firm profitability), and second, we look at the funding received by them.

We estimate the following two separate firm level OLS regression for revenue and funding:

$$Y_{it} = \alpha + \beta_1.WomanFounder_{it} + \beta_2.FracWomenExec_{it} + \beta_3.Size_{it} + YearFE + CountryFE + \epsilon_{it}$$

Where:

Y_{it} is the firm revenue or funding received as the dependent variable, for firm *i* founded in year *t.* The revenue data in the database is expressed in eight categories measuring revenue from less than $1 million to higher than $10 billion. The funding data, on the other hand, is continuous. We convert these variables into a fewer number of categorical dependent variables to help reduce the noise in the raw data. The categorical variable takes the value 1 if the revenue/funding is less than $10 million; the value 2 if revenue/funding is between $10M-$100 million; and the value 3 if the revenue/funding is more than $100M.

$WomanFounder_{it}$ takes the value 1 if the firm *i* founded in year *t* was founded by a woman (solo or as a co-founder) and 0 if the firm is founded by a man.

We control for $FracWomenExec_{it}$ which takes the value between 0 and 1, which is the fraction of women on the executive board of firm *i*.

Given that the size of firms and the representation of women in the firm are correlated, we control for the effect of the size of the firm. $Size_{it}$ is a categorical variable for the size of firm *i* in terms of the number of employees. It takes the value 1 if the number of employees in the firm is less than 50; the value 2 if the firm has between 50 and 250 employees; and the value 3 if the firm has more than 250 employees. We also control for the effect of the year and country in which the firm was established, on the firm's performance.

Results for the two regressions are shown in Tables 1 and 2. The first three columns show the relationship between having a woman founder and the revenue / funding earned by the firm respectively. We add the year and country fixed effects sequentially. In columns (4), (5), and (6) we show the relationship between the share of women on the executive board and the firm's performance. Lastly, in columns (7), (8), and (9) we include both the share of women on board and having a woman founder in the same specification[10].

As shown in Table 1, for revenue, while the coefficient on firms founded by women is negative, they are not significant if we control for country and year fixed effects. Similarly, the impact of the fraction of women executives on a firm's revenue is positive but not significant. Once we look at the fully specified model in columns (7)-(9), we find that even after controlling for the size of the firm and the diversity of firm's executive board, firms with women founders are associated with earning a lower revenue. On the other hand, firms with a higher fraction of women on executive board are associated with earning higher revenue.

We find similar results for funding received by firms in Table 2. In columns (1)-(3), we find a negative and significant relationship between a woman founder and funding received by firms, which is consistent across all

[10] It is plausible that having a woman founder and share of women on board are correlated with each other and therefore the specification may suffer from multicollinearity. We conduct the variance inflation factor and correlation tests of multicollinearity and find that that, while there is some positive correlation between these two factors, multicollinearity is not a problem for these specifications.

specifications. The correlation between the share of women on the executive board on funding received by firms is positive and significant.

To understand the economic significance of our results, we check the robustness of these results by estimating an ordered logit regression model.[11] Results are shown in Tables B1 and B2 in Appendix B. We find that the results are robust, except for the significance of coefficients in columns (2) and (3). Controlling for country and year fixed effects, and the size of the firm, the odds of being a high revenue firm is 75 percent less if the firm is founded by a woman, while the diversity of the executive board does not matter. The odds of receiving high funding are 77 percent less if the firm is founded by a woman. A 1 percent increase in the fraction of women on executive boards is associated with the firm receiving higher funding by 1.3-2.7 percent.

Our results have two limitations. First, the results could be affected by survivorship bias. If we assume women are more risk-averse (Schubert et. al, 1999), make less risky investments, and earn a lower revenue for the firms thereby leading to the respective firm shutting down; it could be possible that we only observe a select group of firms owned by women, or those with a higher share of women in the executive board, that has a strong performance. In that case, these results could be biased and the coefficients on *WomanFounder* and *FracWomenExec* could be overestimated. Second, given data limitations, we cannot identify the causal link in this relationship. It is plausible that firms with a higher revenue stream in the past, or those that are more profitable hire more women. Since we do not have the financial history of these firms, we cannot rule out the reverse causality that might be driving these results. However, the direction of these results gives an interesting insight into the interlinkage between gender and firm performance.

Table 1. OLS Regression: Outcome Variable - Revenue Range

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
WomanFounder	-0.025**	-0.016	-0.016				-0.067***	-0.049***	-0.043*
	(0.010)	(0.012)	(0.014)				(0.015)	(0.018)	(0.022)
51-250	0.257***	0.223***	0.233***	0.277***	0.234***	0.242***	0.254***	0.222***	0.232***
	(0.046)	(0.043)	(0.044)	(0.048)	(0.048)	(0.050)	(0.046)	(0.043)	(0.044)
250+	0.965***	0.835***	0.841***	1.043***	0.873***	0.874***	0.960***	0.833***	0.838***
	(0.074)	(0.084)	(0.089)	(0.087)	(0.093)	(0.096)	(0.073)	(0.084)	(0.088)
FracWomenExec				0.032	0.029	0.025	0.102***	0.080**	0.066*
				(0.023)	(0.022)	(0.019)	(0.035)	(0.032)	(0.034)
Constant	1.053***	2.165***	3.129***	1.046***	2.122***	3.039***	1.046***	2.153***	3.086***
	(0.005)	(0.084)	(0.061)	(0.007)	(0.093)	(0.081)	(0.006)	(0.087)	(0.069)
Observations	2393	2377	2377	2726	2699	2699	2393	2377	2377
Country FE	No	No	Yes	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Standard errors are clustered at the country level

The coefficients for firm size are relative to firms with less than 50 employees

[11] For this model, however, we need data points within each category for revenue and funding, in each year and in each country. Given the lack of such data, the standard errors estimated in these regressions should be interpreted with caution.

Table 2. OLS Regression: Outcome Variable - Funding Range

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
WomanFounder	-0.054*	-0.052*	-0.059*				-0.139**	-0.134**	-0.142**
	(0.030)	(0.029)	(0.031)				(0.054)	(0.055)	(0.057)
51-250	0.676***	0.644***	0.653***	0.673***	0.644***	0.653***	0.670***	0.641***	0.648***
	(0.041)	(0.044)	(0.045)	(0.042)	(0.046)	(0.046)	(0.041)	(0.044)	(0.045)
250+	1.284***	1.259***	1.256***	1.289***	1.260***	1.251***	1.275***	1.254***	1.248***
	(0.072)	(0.077)	(0.089)	(0.056)	(0.068)	(0.085)	(0.071)	(0.077)	(0.090)
FracWomenExec				0.068**	0.064**	0.056*	0.222***	0.214***	0.218***
				(0.032)	(0.031)	(0.033)	(0.074)	(0.078)	(0.077)
Constant	1.253***	1.741***	1.814***	1.239***	1.731***	1.774***	1.240***	1.714***	1.778***
	(0.026)	(0.077)	(0.087)	(0.020)	(0.068)	(0.083)	(0.023)	(0.081)	(0.093)
Observations	2281	2279	2279	2468	2466	2466	2281	2279	2279
Country FE	No	No	Yes	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Standard errors are clustered at the country level
The coefficients for firm size are relative to firms with less than 50 employees

To understand the contrasting findings on the relationship between women founders versus executives on firm performance, it may be useful to refer to the two broad underlying mechanisms identified in the literature. In our findings related to firms founded by women getting less funding as compared to those founded by men, first, experimental literature finds that women invest less and appear to be more financially risk-averse than men (Charness and Gneezy, 2012). Second, the gender bias of investors funding projects may have a role to play. Gender homophily has been known to affect startups, especially those led by women (Greenberg and Mollick, 2015). A recent study by IFC (2019) finds that a gender gap in the representation of women as allocators and recipients of capital reduces the access to finances for female entrepreneurs. Ewens and Townsend (2020) using a proprietary data set from AngelList find that male investors express less interest in female entrepreneurs compared to observably similar male entrepreneurs. In contrast, female investors express more interest in female entrepreneurs.

There are also differences in questions that the women founders are asked at the time of venture capitalist funding. Kanze et. al (2018) identify that the funding gap originates with a gender bias in the questions that the investors pose to entrepreneurs. In their field study in New York City from 2010 through 2016, they find that investors tend to ask male entrepreneurs promotion-focused questions and female entrepreneurs prevention-focused questions, thereby leading to different funding outcomes for the respective entrepreneurs. For example, male entrepreneurs are typically asked questions regarding the potential for gains while women entrepreneurs are typically asked questions related to the potential for losses—or questions focusing on hopes, achievements, advancement, and ideals for the former, and questions concerning safety, responsibility, security, and vigilance to the latter.[12]

[12] https://hbr.org/2017/06/male-and-female-entrepreneurs-get-asked-different-questions-by-vcs-and-it-affects-how-much-funding-they-get

On the other hand, there is also a documented positive relationship between gender diversity in the firm and the firm's performance in the literature, which could imply why such firms received higher funding. Christiansen et. al (2016) use data on gender diversity in senior corporate positions and the financial performance of 2 million companies in Europe. They find that the positive relation is more pronounced in sectors where women form a larger share of the labor force, and where complementarities in skills and critical thinking are in high demand—such as high tech and knowledge-intensive sectors. The latter channel could explain the positive relationship between the revenue or funding received by firms and the share of women executives in those fintech firms.

Section 3: Gender Gaps in Usage of Digital Financial Services

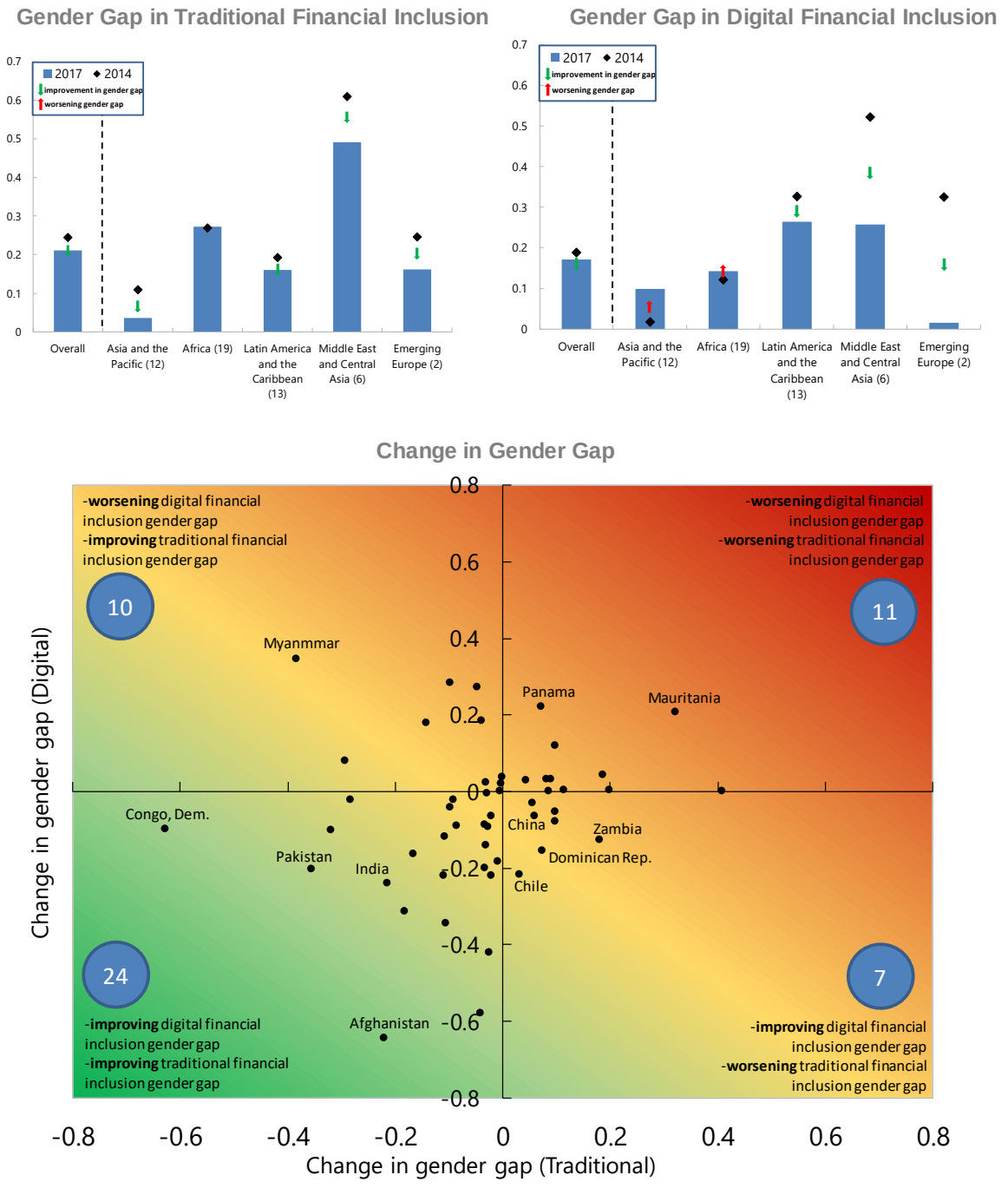
With the increasing access to mobile money and DFS, there is hope that fintech can help in closing the gender gaps in financial inclusion. DFSs could help address constraints that affect women particularly—such as mobility and time constraints by allowing them to access mobile banking accounts from home, and minimum balance requirements that may be more binding for women, among others.

Sahay et al. (2020) examine the gender gaps in financial inclusion using the composite financial inclusion indices they developed using a three-stage principal component analysis, covering 52 emerging market and developing economies for 2014 and 2017. They construct traditional and digital financial inclusion indices based on indicators related to access to and usage of financial services provided by financial institutions (e.g., number of ATMs, account ownership at financial institutions, and their usage to save or for payments) and via digital means (e.g., access to mobile phones and mobile money agents, mobile account ownership and their usage for payments). These two indices are then combined into a comprehensive financial inclusion index. The value of the index ranges between 0 and 1 with 1 being the highest level of digital financial inclusion. They further calculate male and female financial inclusion indices using the same method, based on gender disaggregated underlying indicators. Gender gaps in financial inclusion are measured as the percentage difference of respective female to male index.[13]

The resulting measures indicate that the gender gaps are indeed lower on average in digital financial inclusion than in traditional financial inclusion (Figure 10, upper panel). However, gender gaps are not closing everywhere and significant variation exists across and within geographical regions. In Africa and Middle East, gender gaps in digital financial inclusion were lower than in traditional financial inclusion. The Middle East also saw a stark decline in the gender gap between 2014 and 2017. Latin America, on the other hand, had a higher gender gap in digital financial inclusion but saw a larger narrowing in its gap between 2014 and 2017. In Asia, gender gaps in general were smaller than in other regions, but the gap in digital financial inclusion was slightly higher than in traditional financial inclusion. Overall, 31 of the 52 countries in the sample saw improvements in the gender gap in digital financial inclusion between 2014 and 2017 (of which 24 were accompanied by improvements in the traditional gap); on the other hand, 21 countries saw a widening in the digital financial inclusion gender gap, half of which also saw worsening in the traditional gap as well (Figure 10, bottom panel).

[13] When the gender breakdown is not available, data for the country is used for both male and female (primarily in the case of indicators related to access). This may lead to underestimation of gender gaps.

Figure 10. Gender Gaps in Financial Inclusion



Notes: The gender gap is calculated as a ratio of (Male-Female)/Male
Source: Sahay et al (2020) and authors' calculations.

There is increasing cross-country evidence on the drivers of gender gaps in financial and digital inclusion, while those focused on digital financial services are still limited. A report by OECD (2018) finds that hurdles to access, affordability, lack of education and skills, and technological literacy are correlated with gender-based

digital exclusion. Given the reliance of the fintech industry on technology, the drivers of gender gaps in digital inclusion could in fact exacerbate the gender gaps in traditional financial inclusion. Individual-level factors, as well as economy-wide socio-cultural factors may collectively play a role. By creating a comprehensive index for traditional financial inclusion, Deléchat et. al (2018) find that apart from country-level structural characteristics, legal discrimination against women and gender norms explains part of the gender gaps in access to finance in countries.

We aim to contribute to an understanding of the individual-level factors that affect the persistence of gender gaps, with a particular focus on access to digital financial services and policies that can help reduce these gaps. We regress the gender gap in digital financial inclusion using a random-effects panel regression model based on cross-country data covering 36 EMDEs. Addressing these gender gaps is pivotal not just for equitable concerns, but also since access to fintech or digital financial services can help in improving the lives of women and their families (Aker et al., 2016; Suri et al.,2012; Suri and Jack, 2016; Morawczynski and Pickens, 2009) and have positive macroeconomic implications like reduced inequality (Čihák and Sahay, 2020).

A. Data Source and Summary Statistics

We use the gender gap measure based on the digital financial inclusion index created by Sahay et. al (2020) in our analysis, discussed in the previous section. Table 3 shows year-wise summary statistics of our outcome as well as explanatory variables for countries that are in our sample for the main analysis. A higher value of the index indicates a larger gap. The average gender gap in digital financial inclusion index is 2.8 percent in 2014 and that has increased to 3.7 percent in 2017.

Taking a cue from the literature, we use a rich set of cross-country socio-economic indicators as explanatory variables, including measures of education to capture the skill set or literacy needed to reap benefits from access to DFS, factors that may ease access and affordability of these services for women, and socio-cultural norms.

- *Education attainment and digital literacy*: Khera et al (2021) find a positive relationship between measures of usage of digital finance and traditional finance, which could reflect common factors like financial literacy and trust in the financial system in general. Similarly, OECD (2018) suggests that gender gaps in digital literacy might be a driver of the digital divide between men and women. To test this hypothesis, we use gender gaps in upper secondary education and female share in STEM-related fields as proxies for financial and digital literacy, respectively. Lusardi (2008) defines financial literacy as the knowledge of basic financial concepts which include working of interest compounding, the difference between nominal and real values, and the basics of risk diversification. These concepts are covered in the curriculum in upper secondary grades and therefore we use upper secondary education attainment as a proxy for financial literacy. We expect that an increase in the female share of graduates from STEM would decrease the gender gap in digital financial inclusion. The data for these variables is from the World Bank Gender Statistics. There has been an increase in the gender gap in upper secondary education attainment between 2014 and 2017 from 19.6 percent to 22.0 percent, while the mean share of women in STEM fields has not changed much.

- *Economic independence of women*: Greater economic independence of women alters their financial ability to make purchasing and personal investment decisions and could lead to improved affordability of and increased demand for financial services. We use the ratio of female to male labor force participation as a possible measure of relative economic independence of women that may drive differences in usage of DFS for both genders. A higher ratio may lead to a decline in the gender gap in digital financial inclusion as an increase in the share of working women may also lead to higher financial independence among women and therefore increase their usage of DFS. The data for this variable are extracted from the World Bank Gender Statistics database.

- *Socio-cultural and legal norms*: We use the Women, Business and Law index from the World Bank to capture socio-cultural norms and legal discrimination against women.[14] The index measures gender inequality in the law by analyzing laws and regulations affecting women's economic inclusion in the country, such as those related to mobility, labor force participation, job restrictions and gender wage gap; and marriage. The index takes values between 1 and 100; and a higher value of the index means greater gender equality. We expect that more gender equal norms in the country would be correlated negatively with gender gaps in digital financial inclusion. Between 2014 and 2017, this index has not changed much which is expected, since socio-cultural norms are sticky and slow changing.

Our resultant sample includes 26 countries in 2014 and 36 countries in 2017 for which all the above-mentioned variables are non-missing.

Table 3. Summary Statistics

		2014				2017			
Variable	**Data Source**	**Mean**	**Std. Dev**	**Min**	**Max**	**Mean**	**Std. Dev**	**Min**	**Max**
Gender gap in Digital Financial Inclusion Index	Sahay et al. (2020)	0.028	0.046	-0.130	0.119	0.037	0.032	-0.025	0.112
Gender gap in Upper Secondary education attainment	World Bank Gender Statistics	0.196	0.279	-0.141	0.726	0.220	0.288	-0.220	0.726
Female share of graduates in STEM	World Bank Gender Statistics	15	9.367	4.488	47.336	14.491	8.818	5.430	47.336
Female/Male Labor Force Participation Ratio	World Bank Gender Statistics	64.688	20.599	21.105	94.987	68.382	18.017	21.105	93.992
WBL Index	World Bank	72.634	13.066	31.9	90.6	72.325	14.324	31.9	95
N			26				36		

[14] We use other indicators measuring socio-cultural norms as well, like Social, Institutions and Gender Index, percentage of women who make household purchase decisions, and gender gap in internet usage. However, we do not have the data for these variables across the two time periods of interest (2014 and 2017) and therefore cannot include them in the regression. Their correlation with the outcome variable for 2017 is shown in Figure C1 in the appendix C.

B. Drivers of Gender Gap in Digital Financial Inclusion

We employ a random effects panel regression model to understand the determinants at the country level and policy levers that affect gender gaps in digital financial inclusion. We regress the gender gap in digital financial inclusion on socio-economic and cultural factors, and measures of gender gaps in digital and financial literacy across two time periods – 2014 and 2017. In this model, we are assuming that any variation across the countries is random, and any individual country-specific effect is uncorrelated with the explanatory variables.

We estimate the following model:

$$Gender\_Gap_{it} = \alpha + \beta_1.UpperSecondary_{it} + \beta_2.ShareinStem_{it} + \beta_3.F/MLFP_{it} + \beta_4.WBL_{it} + \beta_5.RealGDPpc_{it-1} + YearFE + CountryFE + \epsilon_{it}$$

Where:

$Gender\_Gap_{it}$ is the ratio between the difference in digital financial inclusion index for men and women, and the index value for men.

$UpperSecondary_{it}$ is the gap between percentage of men and women who are 25 years or older that have attained upper secondary education level in country *i* in time *t*.

$ShareinStem_{it}$ is the female share of graduates from Science, Technology, Engineering and Mathematics in country *i* in year *t*.

$F/MLFP_{it}$ is the ratio of female to male labor force participation rate in country *i* in year *t*.

WBL_{it} is the Women, Business and Law index for country *i* for year *t* measures cultural factors that might affect the gender gaps.

$Real\ GDP\ PC_{it-1}$ is the Real per capita GDP of country *i* in year *t-1*. We control for lagged value of real GDP per capita to avoid endogeneity between GDP and digital financial inclusion a country.

We also control for country and year specific fixed effects to account for country and time specific level effects that might lead to changes in digital financial inclusion index. The variables are added recursively and shown in Table 4. Our preferred specifications are the ones with country and year fixed effects included.

We find that countries with a higher share of women who are graduating in STEM have a lower gender gap in digital financial inclusion. A 1 percent increase in the share of women graduates in STEM education is associated with a 0.2 percent decrease in the gender gap in digital financial inclusion. Once we account for the year and regional fixed effects, the coefficient on the gender gap in upper secondary education attainment is positive and significant, implying that countries associated with a higher gender gap in educational attainment are also associated with a larger gender gap in digital financial inclusion. A 1 percent increase in the gender gap in upper secondary education on average is associated with a 3 percent higher gender gap in digital financial inclusion. These findings suggest that gender differences in financial and digital literacy are key drivers of gender gaps in digital financial inclusion. We find some suggestive evidence that countries with a lower gender gap in labor force participation have lower gender gaps in digital financial inclusion. However, this

result weakens once we include both the year and regional fixed effects. In the last two specifications, the coefficient on the WBL index is negative and significant implying countries with higher gender equality seem to have lower gender gaps in digital financial inclusion. A 10-point improvement in gender equality as measured by the WBL index is associated with a decrease in the gender gap in digital financial inclusion of 1 percent.

These results could be quantitatively altered in recent times owing to the COVID-19 crisis. There are not only fast advances in the usage of digital finance but also an increase in reliance on digital tools for work as well as educational attainment. Apart from level changes in usage of digital finance, changes in gender gaps in reliance on technology may further drive the results to be different if we were to extend the analysis to the post-COVID data. Further research on this topic with current data may be crucial to understand the changes.

Table 4. Random Effects Panel Regression Model:
Outcome – Gender Gap in Digital Financial Inclusion Index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Upper Secondary	0.059	0.021	0.033	0.037	0.045*	0.032	0.036	0.047*	0.035**	0.032**	0.036**
	(0.059)	(0.021)	(0.021)	(0.024)	(0.026)	(0.021)	(0.024)	(0.026)	(0.018)	(0.016)	(0.017)
Share(percent) in STEM		-0.002***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***	-0.002***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
F/M LFP(percent)			-0.001*	-0.001*	-0.001*	-0.001**	-0.001*	-0.001*	-0.001	-0.000	-0.000
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
WBL				0.000	0.000		0.000	0.000		-0.001*	-0.001*
				(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Lagged real GDP pc					0.000			0.000			0.000
					(0.000)			(0.000)			(0.000)
Constant	0.029***	0.062***	0.103***	0.094***	0.090***	0.099***	0.089***	0.082***	0.051	0.068	0.064
	(0.008)	(0.008)	(0.022)	(0.022)	(0.024)	(0.024)	(0.023)	(0.025)	(0.044)	(0.042)	(0.044)
Observations	96	62	62	62	62	62	62	62	62	62	62
Year FE	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	No	No	No	No	No	No	Yes	Yes	Yes

Heteroskedasticity-robust standard errors are included in parenthesis

Section 4: Conclusion and Policy Implications

The role of fintech and other technology-related services has increased substantially during COVID-19. This provides both an opportunity and challenge for narrowing gender gaps. In this paper, we explore the gender gaps in digital financial inclusion from the supply side, by evaluating gender gaps in leadership in fintech and its implication on firm performances, and on the demand side, by exploring the determinants of gender gaps in the usage of digital finance.

We find that there are very few women founders in the fintech industry and the shares of women on executive boards of fintech companies are low. We also find that firms with a higher share of women on the executive board tend to get higher funding and are associated with larger revenues. These results point toward the positive relationship between diversity in the firm's board and firm performance while underscoring the need to

further engage women in this industry. At the same time, addressing biases that the female founders of fintech firms face in raising funds, could facilitate the leadership of women in the industry, and thereby plausibly encourage more women to this industry both as employees and users of fintech.

On the usage side, women face more inequality in education which hinders their ability to access digital finance. We find that the gender gaps in digital financial inclusion are associated with gender gaps in digital literacy and financial literacy, measured by the share of women who complete upper secondary education and graduates in STEM fields respectively. These results highlight the importance of policies that equalize socio-cultural norms and legally back them up to help in narrowing gender gaps in digital financial inclusion. Specifically, focusing on improving women's financial and digital literacy early on may allow countries to fully utilize the potential of DFS in pushing forward their financial inclusion goals.

There is scope for further research on exploring potential links between having more women in leadership positions in the fintech industry and lower gender gaps in digital financial inclusion, and the mechanisms behind this relationship by evaluating whether services provided to female customers are higher and more tailored to women when fintech firms are led by women or the executive board is more gender diverse. Determinants of the gender gap in leadership in fintech firms is a second area worth exploring. In the absence of sufficient data, we were unable to undertake this analysis.

As the adoption of digital financial services accelerates amid the pandemic and in the post-COVID era, there is a risk of new sources of financial exclusion emerging including due to the digital divide. Governments and regulators have a crucial role to play in ensuring the inclusion of women, both as users and leaders, to foster financial inclusion further. Investing in digital and financial literacy should lie high on their agenda. This could lower the gender gaps in the usage of digital financial tools, as well as improve the representation of women in the industry. Specifically, there is a scope to increase the representation of women in STEM-related fields and advocate for policies that reduce gender gaps in employment as these could go a long way in furthering the goals of achieving gender equality in digital financial inclusion. There is also a need to focus on changing gender norms by creating incentives for both women and men and increasing the representation of women in the industry.

APPENDIX A – FIRM CHARACTERISTICS

Table A1: Region and Income group wise number of firms in each economy

Africa	Low income	Ethiopia (1), Rwanda (1), Senegal (1), Tanzania (1), Uganda (7), Zimbabwe (5)
Africa	Lower middle income	Cameroon (2), Côte d'Ivoire (1), Ghana (12), Kenya (23), Nigeria (44), Zambia (2)
Africa	Upper middle income	Namibia (1), South Africa (76)
Asia and the Pacific	High income	Australia (184), Hong Kong SAR (125), Japan (43), New Zealand (18), Singapore (234), South Korea (30), Taiwan Province of China (13)
Asia and the Pacific	Low income	Nepal (2)
Asia and the Pacific	Lower middle income	Bangladesh (2), Cambodia (1), India (452), Indonesia (52), Mongolia (1), Myanmar (6), Philippines (27), Sri Lanka (1), Vietnam (13)
Asia and the Pacific	Upper middle income	China (136), Malaysia (34), Thailand (27)
Europe	High income	Austria (30), Belgium (38), Croatia (4), Cyprus (17), Czech Republic (26), Denmark (52), Estonia (35), Finland (43), France (161), Germany (263), Greece (19), Hungary (15), Ireland (54), Israel (223), Italy (65), Latvia (19), Lithuania (25), Luxembourg (18), Malta (12), Netherlands (92), Poland (47), Portugal (22), Slovak Republic (1), Slovenia (10), Spain (182), Sweden (84), Switzerland (123), United Kingdom (910)
Europe	Lower middle income	Moldova (1), Ukraine (31)
Europe	Upper middle income	Albania (2), Belarus (5), Bosnia and Herzegovina (2), Bulgaria (16), Romania (16), Russian Federation (69), Serbia (3), Turkey (22)
Middle East and Central Asia	Lower middle income	Egypt (13), Georgia (1), Morocco (3), Pakistan (3), Tunisia (2),
Middle East and Central Asia	Upper middle income	Armenia (4), Azerbaijan (1), Iran (8), Jordan (3), Lebanon (10)
Western Hemisphere	High income	Bahamas (1), Barbados (1), Canada (283), Trinidad and Tobago (1), United States (3429)
Western Hemisphere	Upper middle income	Jamaica (2)

The vast majority of the fintech companies in the database were founded in the previous decade, with 88 percent founded after 2010, as shown in Figure A1. While all these fintech companies are classified under "Financial Services", they also fall under multiple industry groups, including Software (40 percent of the firms), Lending and Investment (26 percent), Payments (24.7 percent), Information Technology (16.6 percent),

Internet Services (11 percent), Commerce and Shopping (10 percent), Artificial Intelligence (5.6 percent) and Apps (5.4 percent).

Firm Characteristics

Figure A1. Number of Companies
(by the year in which they were founded)

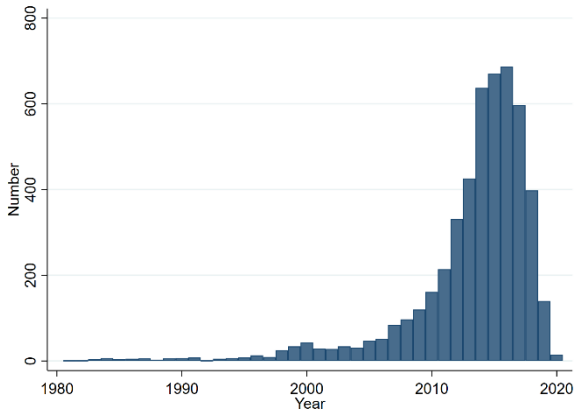
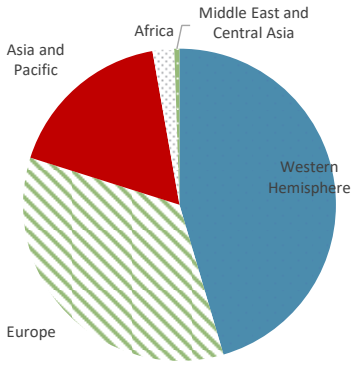


Figure A2. Share of Firms by Region
(In percent)



There is a considerable amount of regional variation in where these firms are located (Figure A2). Table A1 shows the number of firms in each country in the database. 45 percent of firms are in the Western Hemisphere, followed by Europe (34 percent) and Asia and Pacific (17 percent). The largest number of firms are in the United States (over 3,000) and the next highest number of firms are in the United Kingdom – over 900 firms. On the other hand, Africa and, Middle East and Central Asia represent less than 3 percent of the fintech firms in the database.

In terms of firm size, roughly 75 percent are small, with less than 50 employees, while those with more than 250 employees account for less than 8 percent (Figure A3). Analogous to the size of firms, most of the firms are also small financially – 84 percent of firms have revenues less than $10 million, and only around 3 percent have revenue more than $100 million (Figure A4). This reflects in part the relatively young age of the firms—on an average, firms earning less than $10 million are on an average 6.9 years old, those earning $10 million to $100 million are 11.5 years old and those than earn a revenue more than $100 million are 30 years old.

Figure A3. Share of Firms by No. of Employees

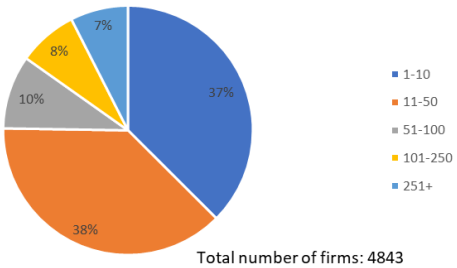
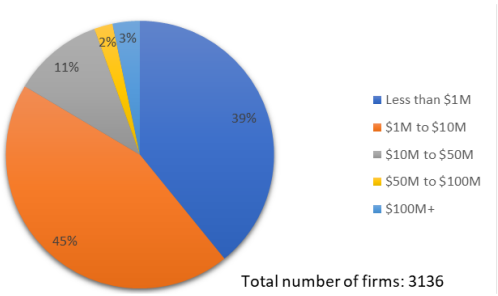


Figure A4. Share of Firms by Revenue Range



APPENDIX B – FIRM REGRESSIONS

Table B1: OLogit Regression: Outcome Variable - Revenue Range

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
WomanFounder	0.757**	0.806*	0.755**				0.570***	0.636***	0.627***
	(0.086)	(0.098)	(0.105)				(0.068)	(0.083)	(0.107)
51-250	8.001***	6.957***	7.783***	8.607***	7.182***	7.909***	7.850***	6.871***	7.664***
	(1.809)	(1.441)	(1.590)	(2.056)	(1.728)	(1.901)	(1.755)	(1.408)	(1.538)
250+	76.097***	55.760***	71.519***	89.141***	59.710***	72.985***	73.840***	54.781***	69.696***
	(20.673)	(15.341)	(18.475)	(28.056)	(19.070)	(21.314)	(19.905)	(14.826)	(17.669)
FracWomenExec				1.374	1.363	1.234	2.357***	2.024**	1.760
				(0.290)	(0.280)	(0.244)	(0.708)	(0.615)	(0.611)
Observations	2393	2377	2377	2726	2699	2699	2393	2377	2377
Country FE	No	No	Yes	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Standard errors are clustered at the country level; Coefficients are odds-ratio

Table B2: OLogit Regression: Outcome Variable - Funding Range

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
WomanFounder	0.810*	0.812*	0.777*				0.566***	0.573**	0.535***
	(0.099)	(0.099)	(0.104)				(0.118)	(0.124)	(0.125)
51-250	10.387***	9.461***	11.065***	10.205***	9.444***	10.923***	10.260***	9.427***	10.958***
	(1.351)	(1.280)	(1.419)	(1.353)	(1.325)	(1.418)	(1.337)	(1.289)	(1.434)
250+	79.428***	76.695***	93.277***	78.295***	76.316***	86.628***	78.254***	76.607***	92.070***
	(19.947)	(21.255)	(29.428)	(16.644)	(19.431)	(27.106)	(19.327)	(21.369)	(29.731)
FracWomenExec				1.385**	1.365**	1.317*	2.615***	2.557***	2.715***
				(0.178)	(0.177)	(0.192)	(0.728)	(0.762)	(0.849)
Observations	2281	2279	2279	2468	2466	2466	2281	2279	2279
Country FE	No	No	Yes	No	No	Yes	No	No	Yes
Year FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Standard errors are clustered at the country level; Coefficients are odds-ratio

APPENDIX C – SOCIO-ECONOMIC AND CULTURAL CORRELATES

We plot some scatter graphs in Figure C1 to show how the gender gap in the digital financial inclusion index (defined as the ratio of digital financial inclusion index for (female-male)/male) developed by Sahay et. al. (2020), varies with a variety of measures of gender equality. The measures used are as follows:

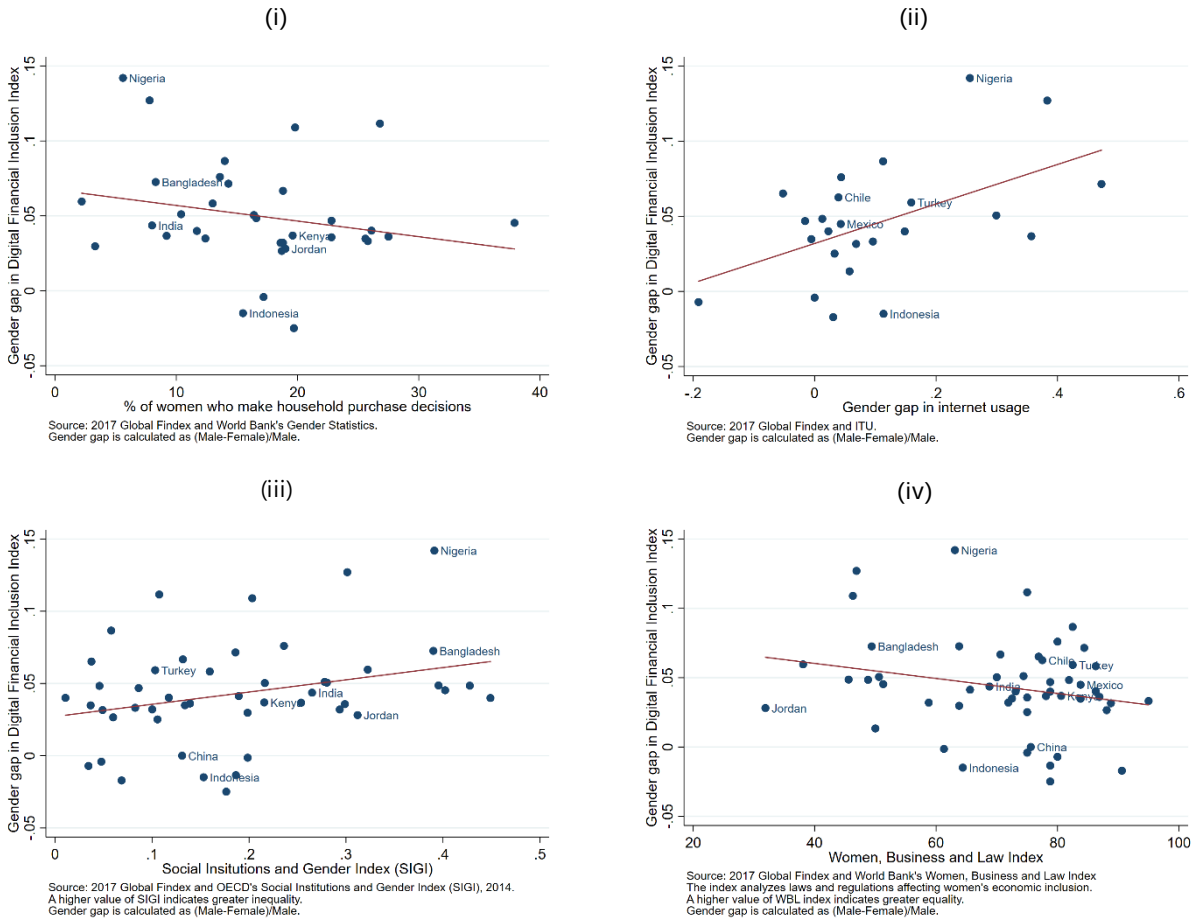
(i) *Percentage of women who make the household purchase decisions* – Using the data from World Bank Gender Statistics we find that there seems to be a slight negative relationship between this measure and the gender gap in digital financial inclusion index, which means that countries where the household purchase decisions are mainly taken by women observe a lower gender gap in digital financial inclusion.

(ii) *Gender gap in internet usage* – Using the recently available data from ITU on internet usage by gender in countries, we find that higher gender gaps in internet usage also seem to be associated with higher gender gap in the digital financial inclusion.

(iii) *Social Institutions and Gender Index* – This index from the OECD Development Centre measures discrimination against women in social institutions across 180 countries. It considers presence of laws and legal frameworks that promote, enforce and monitor gender equality, and track social norms and practices to measure women empowerment. A higher value of the index signifies greater inequality. Countries with higher inequality seem to have a slightly higher gap in digital financial inclusion index between men and women.

(iv) *Women, Business and Law Index* – The index, from the World Bank, also measures gender inequality in the law. It uses indicators on mobility of women, laws affecting women's decision to enter and remain in the labor force, measures laws and regulations concerning job restrictions and gender wage gap; and assess legal constraints related to marriage. A higher value of the index means greater gender equality. Countries with higher equality are associated with lower gender gap in digital financial inclusion index.

Figure C1. Correlates of Gender Gap in Digital Financial Inclusion Index



ANNEX I – SAMPLE ECONOMIES

1. **Economies in the sample for analysis of link between gender diversity on board and firm performance:** Albania, Armenia, Australia, Austria, Bangladesh, Belgium, Bermuda, Bulgaria, Cameroon , Canada , China , Croatia , Cyprus , Czech Republic, Côte d'Ivoire, Denmark, Egypt, Estonia, Ethiopia, European Union (EU), Finland, France, Georgia, Germany, Ghana, Gibraltar, Greece, Guernsey, Hong Kong SAR, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Latvia, Lebanon, Liechtenstein, Lithuania, Luxembourg, Malaysia, Malta, Monaco, Mongolia, Morocco, Myanmar, Namibia, Nepal , Netherlands, New Zealand, Nigeria, Pakistan, Philippines, Poland, Portugal, Romania, Russian Federation, Rwanda, Serbia, Singapore, Slovenia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan Province of China, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United States, Vietnam , Zambia

2. **Economies in the sample for analyzing link between women leaders in fintech and gender gap in digital financial inclusion:** Albania, Armenia, Bangladesh, Cameroon, Egypt, Ethiopia, Georgia, Ghana, India, Indonesia, Iran, Kenya, Malaysia, Mongolia, Morocco, Myanmar, Nigeria, Pakistan, Philippines, Romania, Rwanda, Singapore, South Africa, Tanzania, Thailand, Turkey, Uganda, Vietnam , Zambia

3. **Economies in the sample for analyzing the factors behind gender gaps in digital financial inclusion:** Argentina, Armenia, Bangladesh, Benin, Brazil, Cambodia, Cameroon, Chile, Colombia, Congo, Democratic Republic of, Congo, Republic of, Dominican Republic, El Salvador, Ghana, Guatemala, Honduras, India, Indonesia, Jordan, Kenya, Malaysia, Mexico, Mongolia, Myanmar, Panama, Peru, Philippines, Romania, Rwanda, South Africa, Thailand, Tunisia, Turkey, Uganda, Vietnam , Zimbabwe

ANNEX II – LIST OF VARIABLES

Variable	Source	Description
Firm Revenue	Crunchbase	Categorical variable: $0-10M, $10-100M, and more than $100M
Last Funding received by Firm	Crunchbase	Continuous variable but coded as categorical. $0-10M, $10-100M, and more than $100M
$WomanFounder_{it}$	Crunchbase	Takes the value 1 if the firm i founded in year t was founded by a woman (solo or as a co-founder) and 0 if the firm is founded by a man
$FracWomenExec_{it}$	Crunchbase	takes the value between 0 and 1, which is the fraction of women in executive board of company i
$Size_{it}$	Crunchbase	Continuous variable but coded as categorical. It takes the value 1 if the number of employees in the firm are less than 50, takes the value 2 if the firm has between 50 and 250 employees; and takes the value 3 if the firm has more than 250 employees
$GenderGapMobileAccount_{i2017}$	World Bank Findex, 2017	Difference in mobile banking account ownership between men and women as a share of male account ownership in country i in year 2017
$Gap\_eau\_com_{it}$	Sahay et. al (2020)	Ratio between the difference in digital financial inclusion index for men and women, and the index value for men, i.e. the percentage difference between the difference in digital financial inclusion index for men and women. This is calculated for all countries i for time period 2014 and 2017
$UpperSecondary_{it}$	World Bank Gender Statistics	The gap between percentage of men and women who are 25 years or older, who have attained upper secondary education level in country i in time t
$ShareinStem_{it}$	World Bank Gender Statistics	Female share of graduates from Science, Technology, Engineering and Mathematics in country i in year t.
$F/MLFP_{it}$	World Bank Gender Statistics	Ratio of female to male labor force participation rate in country i in year t.
WBL_{it}	World Bank	Women, Business and Law index for country i for year t
$Real\ GDP\ PC_{it}$		Real per capita GDP of the country i in year t.

References

Aker, Jenny C., Rachid Boumnijel, Amanda McClelland, and Niall Tierney. "Payment mechanisms and antipoverty programs: Evidence from a mobile money cash transfer experiment in Niger." *Economic Development and Cultural Change* 65, no. 1 (2016): 1-37.

Catalyst. "The Bottom Line: Corporate Performance and Women's Representation on Boards (2004-2008)." (2011)

Charness, Gary, and Uri Gneezy. "Strong evidence for gender differences in risk taking." *Journal of Economic Behavior & Organization* 83, no. 1 (2012): 50-58.

Christiansen, Lone, Huidan Lin, Joana Pereira, Petia B. Topalova, and Rima Turk-Ariss. "Gender diversity in senior positions and firm performance: Evidence from Europe." *IMF Working Paper* No. 16/50 (2016).

Cihak, Martin, and Ratna Sahay. Finance and inequality. International Monetary Fund, 2020.

Credit Suisse. "Gender Diversity and Corporate Performance." Credit Suisse AG (2012).

Deléchat, Corinne, Monique Newiak, Rui Xu, Fan Yang, and Göksu Aslan. "What is driving women's financial inclusion across countries?". *IMF Working Paper* No. 18/38 (2018).

Demirguc-Kunt, Asli, Leora Klapper, Dorothe Singer, Saniya Ansar, and Jake Hess. "The Global Findex Database 2017: Measuring financial inclusion and the fintech revolution". The World Bank (2018).

D'espallier, Bert, Isabelle Guérin, and Roy Mersland. "Women and repayment in microfinance: A global analysis." *World Development* 39, no. 5 (2011): 758-772.

Ewens, Michael, and Richard R. Townsend. "Are early stage investors biased against women?." *Journal of Financial Economics* 135, no. 3 (2020): 653-677.

Greenberg, Jason, and Ethan Mollick. "Leaning in or leaning on? Gender, homophily, and activism in crowdfunding." *In Academy of Management Proceedings* (2015).

Hunt, V., D. Layton, and S. Prince. "Why diversity matters". McKinsey & Company Insights & Publications. (2015).

IFC. "Moving towards gender balance in private equity and venture capital." (2019)

Kanze, Dana, Laura Huang, Mark A. Conley, and E. Tory Higgins. "We ask men to win and women not to lose: Closing the gender gap in startup funding." *Academy of Management Journal* 61, no. 2 (2018): 586-614.

Khera, Purva, Stephanie Ng, Sumiko Ogawa, and Ratna Sahay. "Is Digital Financial Inclusion Unlocking Growth?" *IMF Working Paper* No. 21/167 (2021)

Lusardi, Annamaria. "Financial Literacy: An Essential Tool for Informed Consumer Choice?" *NBER Working Paper* No. 14084 (2008)

Morawczynski, Olga, and Mark Pickens. "Poor people using mobile financial services: observations on customer usage and impact from M-PESA." *Working Paper* 9492 (World Bank, Washington, DC) (2009).

Murata, Akira and Erica Paula Sioson. "Financial literacy programs for remittances. Migration and Remittances for Development in Asia". ADB-World Bank Co-Publication. (2018)

OECD. "Bridging the digital gender divide: include, upskill, innovate." (2018)

Sahay, Ratna, and Martin Cihak. “Women in Finance: A Case for Closing Gaps” *Staff Discussion Note* No. 18/05 (2018). International Monetary Fund.

Sahay, Ratna, Martin Cihak, Purva Khera, and Sumiko Ogawa. “Women and Finance in the Post-COVID World”. Forthcoming *Staff Discussion Note* (2022). International Monetary Fund

Sahay, Ratna, Ulric Eriksson von Allmen, Amina Lahreche, Purva Khera, Sumiko Ogawa, Majid Bazarbash, and Kimberly Beaton. “The Promise of Fintech; Financial Inclusion in the Post COVID-19 Era”. IMF Working Paper No. 20/09 (2020).

Schubert, Renate, Martin Brown, Matthias Gysler, and Hans Wolfgang Brachinger. "Financial decision-making: are women really more risk-averse?." *American economic review* 89, no. 2 (1999): 381-385.

Sioson, Erica Paula, and Chul Ju Kim. "Closing the Gender Gap in Financial Inclusion through Fintech." Asian Development Bank (2019).

Suri, Tavneet, and William Jack. "The long-run poverty and gender impacts of mobile money." *Science* 354, no. 6317 (2016): 1288-1292.

Suri, Tavneet, William Jack, and Thomas M. Stoker. "Documenting the birth of a financial economy." *Proceedings of the National Academy of Sciences* 109, no. 26 (2012): 10257-10262.

PUBLICATIONS

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