



The fintech gender gap[☆]

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ABSTRACT

Can fintech close the gender gap in access to financial services? Using novel survey data for 28 countries, this paper finds a large and ubiquitous ‘fintech gender gap’: while 29% of men use fintech products, only 21% of women do. This difference exceeds the gender gap in bank account ownership at traditional financial institutions. While country characteristics and individual-level controls explain about a third of the fintech gender gap, the residual gap declines by 60% when accounting for gender differences in the willingness to use new financial technology, the suitability of fintech products, and the willingness to use fintech entrants if they offer cheaper products. The paper concludes by discussing drivers of differences in attitudes and implications for policy to foster financial inclusion with new technology.

1. Introduction

Better access to financial services can improve individuals’ employment outcomes, wealth accumulation and propensity to start a business (Guiso et al., 2004; Brown et al., 2019; Célerier and Ma-ray, 2019). And yet, women all over the world remain unbanked or underbanked relative to men: they have lower rates of bank account ownership (Demirgüç-Kunt et al., 2017), are less likely to manage household finances (Guiso and Zaccaria, 2021) and participate less in the stock market (Ke, 2021).

Hopes are high that new financial technology – or ‘fintech’ – can enhance financial inclusion and close the gender gap in the access to financial services (Demirgüç-Kunt et al., 2018; Breza et al., 2020). Indeed, an explicit policy goal of the G20 is to harness financial digitisation to benefit women (G20, 2022). By leveraging new technology and non-traditional data, both traditional financial institutions (‘incumbents’) and new fintech firms (‘fintech entrants’) promise to offer novel products better tailored to consumers’ needs at a lower cost (Buchak et al., 2018; Philippon, 2020; Thakor, 2020). These technological advances could benefit disadvantaged groups disproportionately (Suri and

Jack, 2016; Bachas et al., 2021; Lee et al., 2021). However, evidence on whether fintech helps to close the gender gap in the access to and use of financial services is scarce, especially in the cross-country context.

This paper uses data from a large survey of over 27,000 adults from 28 major economies to investigate gender differences in the adoption of new financial technology. The survey sample is representative along the age and gender distributions and includes details on individuals’ use of fintech products and attitudes towards fintech entrants and incumbents. It also contains detailed information on respondents’ socio-economic characteristics.

Our key finding is the presence of a large and ubiquitous ‘fintech gender gap’: women are significantly less likely to use fintech products or services offered by fintech entrants than men. On average, 29% of men report having used fintech entrants over the previous six months. The respective figure for women is 21%. The gap is present in almost all countries in our sample and not fully explained by a large set of individual or country-specific characteristics. The unconditional fintech gender gap of 8 percentage points (pp) also exceeds the gap in bank

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account ownership, which averages 7 pp (Demirgüç-Kunt et al., 2018). These numbers suggest that fintech entrants have so far not closed the gender gap in the access to financial services.

What could explain the gender gap in the use of financial technology? One potential explanation are privacy concerns. Women are generally more concerned about implications of data-sharing for their personal safety (Armantier et al., 2021), which could stand in the way of widespread adoption of financial technology. The adoption of technology also depends on its ease of use and to what extent it offers improved products (Thakor, 2020), with differences in the importance of these factors across genders (Riquelme and Rios, 2010). Finally, men might be more willing to adopt new financial technology if it provides cheaper offers, as their demand generally exhibits a higher price elasticity (Farrelly et al., 2001; Cockx and Brasseur, 2003).

We examine to what extent gender differences along these dimensions explain the fintech gender gap. We first show that controlling for whether an individual worries about her or his security does not materially affect the estimate of the gap, even though women report more than men that they worry about their security when dealing with companies online. Second, we find that women report being significantly less willing than men to adopt new financial technology in general, and are less willing to use a fintech entrant for cheaper offers or when it offers better products or products that are better-suited to the respondent's lifestyle. When we control for these differences in attitudes towards financial technology, the gap narrows by 60%. Mediation analysis shows that differences in the suitability of products and price sensitivity each account for around one quarter of the 60% decline, while attitudes towards new technology account for the remaining half.

We also investigate alternative explanations for the gap. Men are often more likely to make financial decisions within households (Kim et al., 2017; Guiso and Zaccaria, 2021). Such traditional gender roles could explain women's lower use of fintech. Yet we find that the gender gap is also present among respondents who live alone. Moreover, while differences in financial literacy across genders could affect the use of financial services (Lusardi and Mitchell, 2014), we find a significant gap also among respondents who feel confident in their ability to conduct financial planning (a proxy for financial literacy). In respondent-product level regressions, we further find that the gender gap is around 50% smaller among products that complement traditional banking services, relative to those that are substitutes. This pattern suggests that women might be more willing to use products that complement familiar financial services. It is consistent with recent literature showing that fintech entrants are a complement to traditional banks (Fuster et al., 2019; Tang, 2019). The smaller gap among complementary products could suggest that the gender gap is less pronounced for fintech products offered by traditional banks. We find that 49% of respondents use novel financial products and services that are offered by traditional financial institutions, compared with 25% for fintech entrants. However, men are significantly more likely to use fintech products irrespective of the provider, which implies that the gender gap is not specific to *who* provides fintech products or services, but rather to the products themselves.

All in all, our results suggest that the gap in the use of fintech is closely linked to differences in attitudes towards technology, the fit of products to users' needs and lifestyle, as well as users' price sensitivity. A number of potential explanations for differences in attitudes stand out. They could be explained by differences across genders in risk aversion or confidence (Croson and Gneezy, 2009; Dohmen et al., 2011; Bucher-Koenen et al., 2021), or differences in the costs and benefits that consumers attach to the use of these new products. They could also result from gender-based discrimination (Bartlett et al., 2022), for example from bad previous experiences by women with financial institutions and biased loan officers (Brock and De Haas, 2022). Finally, the gap could arise from social norms or laws that affect the cost-benefit trade-off differently across genders (Falk and Hermle, 2018; Hyland et al., 2020). For instance, if women have reason to worry more about

a leak of personal data, then it may be rational to avoid services that require collection and processing of personal data.¹ Future research focusing on the determinants of these factors could be particularly promising in identifying the underlying drivers of the fintech gender gap and inform policies that aim to enhance financial inclusion through financial technology.

Our paper contributes to the current literature on the effects of financial technology on financial inclusion and the gender gap in access to financial services (see Demirgüç-Kunt et al. (2017) for a survey). Recent work argues that fintechs could spur financial inclusion, for example by reducing the costs of financial intermediation (Arner et al., 2020; Philippon, 2020; Sahay et al., 2020; Boot et al., 2021) or changing consumer behaviour (Carlin et al., 2019; Breza et al., 2020). To what extent fintech has actually helped bank the un- or underbanked, however, remains an open question. While Fuster et al. (2019) and Tang (2019) show that fintech often serves as a complement, rather than a substitute, to traditional banking services, Hau et al. (2018), Jagtiani and Lemieux (2018), Agarwal et al. (2019) and Frost et al. (2019) argue that fintech and big tech lenders serve borrowers that are traditionally underserved by banks. Our findings provide novel evidence for a fintech gender gap in a large sample of countries and suggest that, so far, fintech falls short of closing the gap in access to finance between men and women.

Our results also have a bearing on the design of privacy protection legislation. In our cross-country sample, we find that the willingness to share data and concerns about privacy differ by gender. Policies that assign each user control over their data (Acquisti et al., 2016; Jones and Tonetti, 2020), such as the California Consumer Privacy Act (Doerr et al., 2023), might prove effective in accounting for these gender differences in privacy concerns. Policies that constrain intermediaries in the amount of information they can collect, and do so irrespective of differences in consumers' privacy preferences, arguably hold less promise. An additional implication is that algorithms trained on non-representative data, which are then used to derive conclusions about the general population, could lead to an inefficient outcome (Bergemann et al., 2022).²

The rest of this paper is organised as follows. Section 2 describes the survey data. Section 3 contains our empirical analysis of the fintech gender gap. It also investigates general differences in attitudes and whether the gap differs depending on who provides the fintech product or service. Section 4 discusses the implications of our findings for public policy.

2. Data

In this section, we explain the data and construction of main variables. The Online Appendix provides further details.

Our main source of data is the EY Global Fintech Adoption Index (2019). The purpose of the survey is to get an understanding of global fintech adoption trends across markets and demographic groups. The consumer survey is based on 27,103 interviews with adults between February and March 2019 in 28 countries around the world.³ The countries in the sample represent around 82% of global GDP and 58% of the world population. The sample is drawn from a standing panel provided by the survey company Ipsos Group, where the sample is constructed to mirror the age and gender distribution within each country.

¹ Okat et al. (2020) argue that trust in traditional financial institutions is not a significant driver of fintech adoption, while (Yang, 2020) shows that a scandal in the US banking sector has led to an increase in fintech adoption.

² See the debate on algorithmic fairness and bias in data (Kleinberg et al., 2015; Corbett-Davies and Goel, 2018; Kleinberg et al., 2018).

³ Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Colombia, France, Germany, Hong Kong SAR, India, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Peru, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Table 1
Summary statistics.

	All mean	Female mean	Male mean	Gap mean
Uses fintech entrants	0.25	0.21	0.29	0.08
... for payments	0.21	0.17	0.24	0.07
... to invest	0.09	0.07	0.12	0.05
... to borrow	0.06	0.05	0.08	0.03
... for financial planning	0.06	0.05	0.07	0.02
... for insurance	0.09	0.07	0.11	0.04
Uses traditional FI	0.49	0.45	0.54	0.09
... for payments	0.40	0.37	0.44	0.07
... to invest	0.13	0.10	0.17	0.07
... to borrow	0.08	0.07	0.09	0.02
... for financial planning	0.09	0.08	0.10	0.02
... for insurance	0.16	0.13	0.18	0.05
Willing to share financial data	0.37	0.33	0.42	0.09
... with fintechs	0.23	0.19	0.27	0.08
... with other financial institutions	0.30	0.26	0.34	0.07
... with non-financial services companies	0.17	0.15	0.20	0.05
Worry about security online	0.69	0.70	0.68	-0.02
Would use digital bank	0.37	0.32	0.42	0.09
Unsure how to plan for financial future	0.35	0.37	0.31	0.06
Observations	27103	13569	13534	27103

Note: This table shows summary statistics for the main variables. It provides the average share of respondents that agreed or strongly agreed with each statement. Column *all* refers to the sample average, columns *female* and *male* to the average for female and male respondents. Column *gap* indicates the average male–female gap.

Specifically, Ipsos Group sends an invitation to all individuals that are part of their standing panel to take part in the online survey. Interview slots are then allocated on a first come, first serve basis, taking into account the sample selection criteria. Respondents are remunerated for participation.

The survey is translated and administered in local languages. Answers to demographic questions, such as on income, education or employment status, are adapted to reflect the characteristics of each economy, and then grouped to allow for global comparability. Questions about income levels were posed in each market's local currency.

The survey asks detailed questions about individuals' use of and attitude towards fintech products provided by fintech entrants and traditional financial institutions. Fintech entrants are defined as companies providing innovative, technology-enabled financial services. The survey groups fintech products within five broad categories: money transfer and payments, budgeting and financial planning, savings and investments, borrowing and insurance. Within these categories, there are a total of 19 individual products. Interviewers describe each product in non-technical terms and provide the names of market-specific providers of those services as examples.

The online survey only includes demographic sub-groups that are digitally active. Yet internet access and mobile phone ownership differ across countries. Moreover, women are less likely than men to be digitally active, especially in developing countries (Barboni et al., 2018). How large are these differences across and within countries among our sample of advanced and emerging market economies? Data from the Gallup World Poll and the World Bank for 2019 show that in the median country in our sample, 89% of the population uses mobile phones; for internet access, the respective number is 80%. The male–female gap in mobile phone usage among our countries averages only 2%, compared to 6% globally.

As discussed in more detail below, we control for cross-country differences, including digital access, through country fixed effects. However, country fixed effects cannot fully absorb gender differences within countries. While we cannot directly account for the selection into being digitally active at the individual level, the potential selection effect would likely increase the estimated fintech gender gap: women without access to mobile phones or the internet are more likely to report that they have never used fintech products, as these rely on digital technology. As there are more women than men who are not

digitally active, our estimates of the fintech gender gap likely represent a lower bound of the actual gap.⁴

A related concern about the external validity of our analysis is that respondents to the online survey could differ from the general population. For example, those willing to take part in the survey could be more price sensitive or less concerned about sharing their data. Moreover, it is possible that individual characteristics and attitudes towards fintech across genders differ between survey participants and the general population. The survey design does not allow us to examine to what extent participants and non-participants differ, nor how these differences vary across genders. The caveat of potential differences in attitudes between the (unobservable) offline sample and the online survey sample should be kept in mind when generalising our results.

Our main explanatory variable is the dummy *uses fintech entrant*, or *uses FT* for short. It takes on a value of one if a respondent has responded that he or she has used a fintech product in at least one of the five categories money transfer and payments, budgeting and financial planning, savings and investments, borrowing and insurance over the last six months. It takes on a value of zero if a respondent has not used any fintech product in either category.

Generally, fintech products are proclaimed to differ along three dimensions: their use of new technology and big data; offering cheaper services than comparable offerings by traditional providers; and providing products that better cater to specific consumer needs or offer a better user experience. We define the following three variables that capture these aspects: *FT technology*, *FT pricing* and *FT products*. Each variable is based on the first principal component of a set of questions that proxy individuals' attitudes towards new financial technology, price advantages and better-tailored products. Higher values indicate that an individual is more willing to (i) adopt new financial technology in general, (ii) adopt fintech products to obtain cheaper offers, and (iii) adopt fintech because it offers better-suited products. We report the detailed questions underlying the construction of these variables in the Online Appendix.

We construct the following controls at the individual level: log of age, dummy *single* that takes a value of one for individuals not

⁴ Consistent with this argument, the estimated gender gap in the use of fintech increases slightly in magnitude when we restrict the sample to countries where the male–female gender gap in mobile usage exceeds 2% (unreported).

living with a partner, dummy *employed* that takes a value of one if an individual is employed, dummy *uses FI* that takes a value of one if an individual has used a traditional financial institution (FI) for novel financial products over the last six months, dummy *income group* that reflects an individual’s position in seven distinct buckets within the country-specific income distribution and a *higher education* dummy for whether an individual has a higher education degree. We have no direct measure of financial literacy, which has been shown to matter for the adoption of financial services (Cole et al., 2011) and can differ across genders (Gomes et al., 2021). Instead, we proxy financial literacy by defining the dummy *financial planning* that takes a value of one if a respondent disagreed or strongly disagreed with the statement ‘I am unsure how to plan best for my financial future’.

For country-level comparisons, we collect data on GDP per capita from the World Bank. We further construct a gender equality index similar to Falk and Hermle (2018) that is based on the first principal component of the male–female labour force participation ratio, the World Economic Forum’s Global Gender Gap and the United Nation’s Gender Inequality Index.

Table 1 provides summary statistics for our key variables. It reports the share of overall respondents (column *all*) who answer with yes to a given question, and the respective shares of *female* and *male* respondents that answer yes. The final column *gap* reports the male minus female difference in means for each question. On average, the overall gender gap in the use of fintechs equals 8 pp.⁵

In terms of individual characteristics, 50% of respondents are female and the average (median) age is 43 (40) years (Fig. 1, panel a). Two-thirds of respondents are working (full- or part-time or self-employed) and 15% live alone. Around 5% of respondents are unemployed and looking for work. Among those who are not working or unemployed, 15% report being a full-time parent or homemaker, 44% report being retired and 21% report being a student. Around 48% of respondents have a higher education degree and 35% are unsure how to best plan for their future. Conditional on reporting their income, female respondents belong to slightly lower income groups. They are less likely to live alone, work or have a degree and more likely to agree that they are unsure how to best plan for their future (panel b).

3. Empirical analysis

This section presents our main finding on the fintech gender gap and investigates potential explanations for the gap.

3.1. The fintech gender gap

Fig. 2, panel (a) shows a sizeable gender gap in the use of fintech entrants. The panel plots the average share of female (black dots) and male respondents (red diamonds) who have used fintech products or services within the last six months by country. Vertical lines denote the sample averages for women (black line) and men (red line). Across countries, 29% of men use fintech products, but just 21% of women. In 26 out of the 28 countries men report using fintech entrants more than women.

⁵ Note that the average overall gap mean of *uses FT* exceeds the mean of its sub-components, which arises from the fact there is overlap among the use of fintech products in different categories. To see why, suppose there are ten male and ten female respondents, as well as two product categories (A and B). Suppose three men and two women use product A, and two men and one woman use product B. This would result in a gap of 10% for product A as well as B. If the same men and same women use both products, this would result in an aggregate gap of 10%. However, if the women (men) that use product A do not use product B and vice versa, the aggregate gap would be 20%. The data show that the gender gap in the use of fintech products and services in more than one category is smaller than the overall fintech gap as measured with *uses FT*, suggesting more overlap among female respondents.

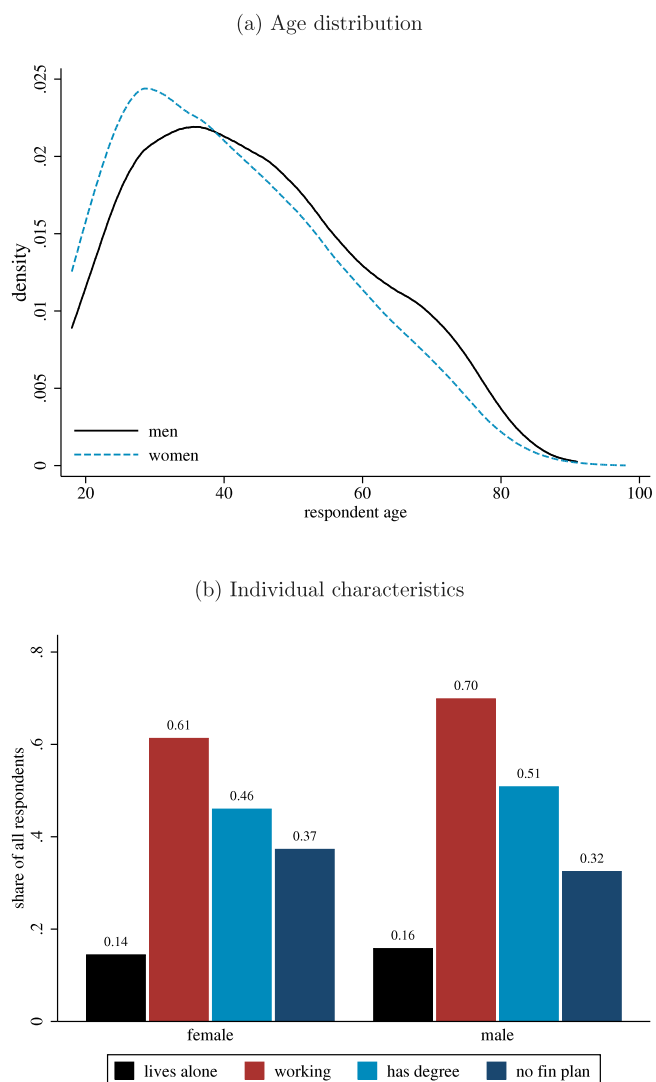


Fig. 1. Summary statistics by gender. Note: Panel (a) shows the age distribution by gender. Panel (b) shows the sample average of respondents by gender that reports living alone, is employed or self-employed, has a higher education degree, and is unsure how to best plan for their future.

To investigate the gap in greater detail, we estimate the following regression:

$$y_i = \beta \text{female}_i + \text{controls}_i + \theta_c + \varepsilon_i. \tag{1}$$

In the baseline specification, the dependent variable y_i is a dummy with a value of one if individual i has used fintech entrants over the last six months, and zero otherwise. The dummy *female* takes on a value of one for female respondents and zero for males. A coefficient of $\beta < 0$ indicates that women have used fintech entrants less than men on average. To account for differences across individuals, we include the following individual-level controls: $\log(\text{age})$; dummies *single*, *employed*, *uses FI* and *financial planning*; as well as an individual’s relative *income group* and *education group*. θ_c denote country fixed effects, which absorb any observable and unobservable differences across countries, for example in GDP per capita, internet access or gender equality. All regressions use robust standard errors.

Table 2 shows that women are less likely to use fintech products than men. In column (1), the unconditional difference averages 8.4 pp. Once we add individual controls in column (2) the difference narrows, but women still are 5.9 pp less likely to use fintech products among

Table 2
The use of fintech services.

VARIABLES	(1) uses FT	(2) uses FT	(3) uses FT	(4) uses FT prod	(5) uses FT prod
female	-0.084*** (0.005)	-0.059*** (0.005)	-0.052*** (0.005)	-0.011*** (0.001)	-0.011*** (0.001)
Observations	27,103	27,103	27,103	514,957	514,957
R-squared	0.009	0.168	0.222	0.076	0.090
Controls	-	✓	✓	✓	✓
Country FE	-	-	✓	✓	✓
Product FE	-	-	-	-	✓
Mean of y	0.25	0.25	0.25	0.05	0.05

Note: This table reports results for Eq. (1) in columns (1)–(3). The dependent variable is dummy *uses FT*, which takes on a value of one if a respondent has used fintech entrants over the last six months, and zero otherwise. Columns (4)–(5) report results for regressions at the respondent-product level for 19 distinct fintech products. For each product, the dependent variable *uses FT prod* is a dummy that takes on a value of one if a respondent has used fintech entrants for that product over the last six months, and zero otherwise. Dummy *female* takes on a value of one if a respondent is female, and zero otherwise. *Product FE* denote 19 distinct product-level fixed effects. Each regression uses robust standard errors, shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

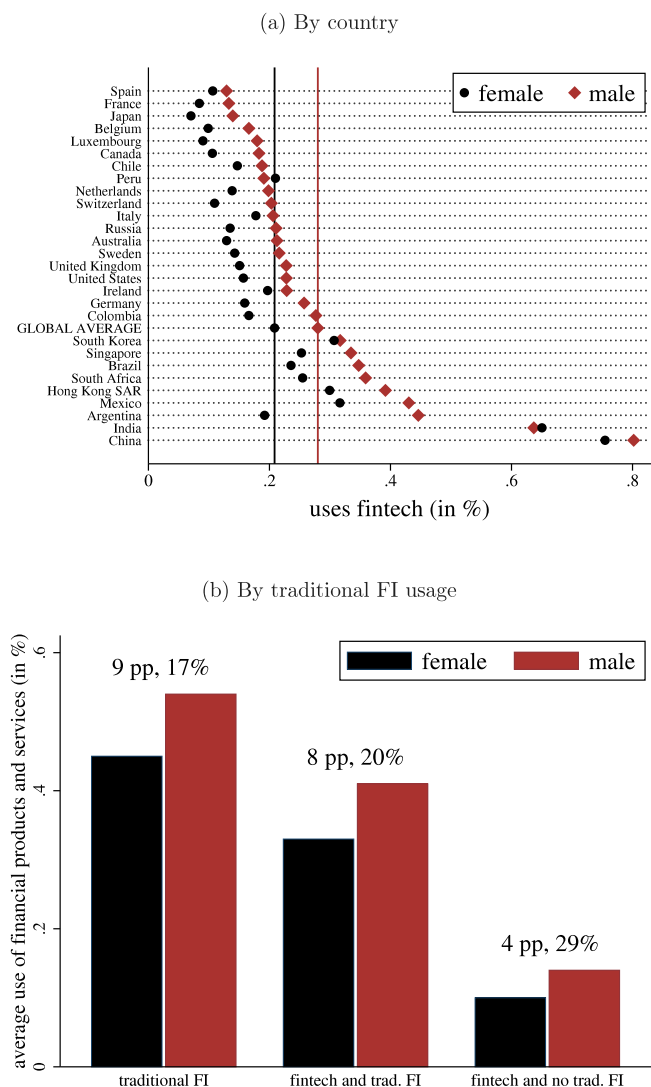


Fig. 2. The fintech gender gap.
Note: Panel (a) shows the average share of female (black dots) and male (red diamonds) respondents that use products offered by fintech entrants for each country. Vertical lines denote the unweighted sample average. Panel (b) reports the average share of female (black bars) and male (red bars) respondents that use fintech products. The left bars report the share of female and male respondents that use traditional FIs for these services, the centre bars report the share that uses fintech entrants but also use traditional FIs, and the right bars report the share that uses fintech entrants but does not use traditional FIs.

respondents of similar characteristics. Our sample contains advanced and emerging market economies that differ along several dimensions, which could affect the availability and adoption of fintech products.⁶ Column (3) thus accounts for any unobservable country characteristics by inclusion of country fixed effects. The gender gap narrows in magnitude to 5.2 pp, but remains highly significant.

Results in columns (1)–(3) suggest that observable individual characteristics and country-specific differences account for 38% of the unconditional gap. Yet even after accounting for these factors, a sizeable difference remains. To put results into perspective, 25% of all respondents use fintech entrants, so the difference between men and women in column (3) represents over 20% of the average adoption rate.

Fintech products differ in scope: some products offer cross-border payments, while others facilitate investment decisions or offer peer-to-peer loans. If men and women use fintechs for different types of products, then the gender gap could be present *across* products, but not *within* similar products. For example men are generally more likely to use investment products (Gargano and Rossi, 2018). Columns (4)–(5) hence estimate regressions at the respondent-product level for 19 distinct fintech products. Similar to Eq. (1), the dependent variable is a dummy with a value of one if individual *i* has used a fintech product of type *p*. Column (4) shows that women are also significantly less likely to use fintech entrants at the product level. Conditional on controls and country fixed effects, the gender gap at the product level equals 1.1 pp, or 23% of the mean of 4.6%. To compare the use of fintech products and services within the same category, column (5) adds product fixed effects. Exploiting only variation within products, the coefficient on the dummy *female* remains identical to that in column (4), while the R-squared increases slightly.

Taken together, results in Table 2 show a sizeable and robust gender gap in the use of financial services that is not explained by country characteristics or differences in the use of certain products.

3.2. Attitudes towards fintech

Women are generally more concerned about implications of data-sharing for their personal safety (Armantier et al., 2021), which could stand in the way of widespread adoption of financial technology. Moreover, the adoption of technology can depend on its ease of use and to what extent it offers improved products (Thakor, 2020), with differences across genders (Riquelme and Rios, 2010). Finally, men might be more willing to adopt new financial technology if it provides cheaper offers, as their demand generally exhibits a higher price elasticity (Farrelly et al., 2001; Cockx and Brasseur, 2003). To investigate

⁶ For example, funding for fintechs is higher in countries with more innovation capacity and better regulatory quality (Cornelli et al., 2021).

Table 3
Differences in attitudes.

VARIABLES	(1) worry sec	(2) PCA technology	(3) PCA pricing	(4) PCA products	(5) uses FT	(6) uses FT	(7) uses FT	(8) uses FT
female	0.026*** (0.006)	-0.042*** (0.003)	-0.039*** (0.003)	-0.035*** (0.003)	-0.053*** (0.005)	-0.031*** (0.005)	-0.023*** (0.004)	-0.022*** (0.004)
worry about security					0.018*** (0.005)	0.020*** (0.005)	0.015*** (0.005)	0.011** (0.005)
PCA technology						0.525*** (0.011)	0.427*** (0.011)	0.271*** (0.013)
PCA pricing							0.296*** (0.011)	0.257*** (0.012)
PCA products								0.269*** (0.011)
Observations	27,103	27,103	27,103	27,103	27,103	27,103	27,103	27,103
R-squared	0.076	0.216	0.155	0.219	0.222	0.299	0.322	0.344
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Mean of y	0.69	0.38	0.20	0.26	0.25	0.25	0.25	0.25

Note: This table reports results for Eq. (1). In column (1), the dependent variable *worry sec* is a dummy that takes on a value of one if a respondent agrees to the statement 'I worry about my security when dealing with companies online', and zero otherwise. In column (2), the dependent variable *FT technology* is the first principal component of a set of questions that measure individuals' attitudes towards new financial technology. In column (3), the dependent variable *FT pricing* is the first principal component of a set of questions that measure individuals' attitudes towards potential price advantages of fintech entrants. In column (4), the dependent variable *FT products* is the first principal component of a set of questions that measure individuals' attitudes towards better-tailored products offered by fintech entrants. In columns (5)–(8), the dependent variable *uses FT* is a dummy that takes on a value of one if a respondent has used fintech entrants over the last six months, and zero otherwise. Dummy *female* takes on a value of one if a respondent is female, and zero otherwise. Each regression includes individual-level controls and country fixed effects and uses robust standard errors, shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

whether these factors are determinants of the gender gap, we first document differences between women and men in their reported attitudes towards privacy and technology. We then analyse to what extent gender differences in attitudes can account for the fintech gender gap.

Column (1) in Table 3 shows that women worry more about their security when dealing with companies online than men. Relative to the mean of the dependent variable (69%), the difference of 2.6 pp is small. Columns (2)–(4) use the three variables that capture individuals' general attitudes towards fintech products, as defined in Section 2: *FT technology* measures how comfortable respondents are with the use of new financial technology; *FT pricing* measures whether respondents are willing to use fintech entrants if they provide cheaper offers for comparable products than traditional FIs; and *FT products* captures the willingness of individuals to use fintech entrants because they better cater to specific consumer needs or offer a better user experience. Column (2) shows that women report being significantly less willing to adopt new financial technology, such as digital banks, than men. Column (3) suggests that men are more willing to use a fintech entrant or share their personal data with an entrant for cheaper offers. Column (4) indicates that women report being less willing to use a fintech entrant even if it offers tailored products that are better-suited to a respondent's lifestyle.

Investigating differences in these attitudes and their role in narrowing the fintech gender gap can offer insights into the factors underlying the observed gap. In columns (5)–(8) we thus examine how directly accounting for differences in attitudes affects our estimates of the gender gap. Across columns, we add each outcome variable from columns (1)–(4) as a mediator. Controlling for whether an individual worries about his or her security in column (5) does not materially affect the coefficient on *female*. Once we control for attitudes towards technology in column (6), the gap narrows to 3.1 pp. Further accounting for individuals' price sensitivity in column (7) reduces the gap to 2.3 pp. Taking into account the suitability of products in column (8) reduces the coefficient of *female* to 2.2 pp. The overall drop in coefficient size is large: Table 2 showed that individual characteristics and country fixed effects reduce the gap from 8.4 pp to 5.2 pp. Accounting for attitudes towards technology, price sensitivity, and the suitability of products, the remaining gap declines from 5.2 pp to 2.2 pp. Thus, the variables included in column (8) explain a combined total of 75% of the gap.

Our measures of attitudes could be subject to measurement error. As discussed in le Cessie et al. (2012) and VanderWeele (2016), classical

measurement error in the mediating variable has the consequence that the indirect effect (ie the effect 'explained' by the mediator) will be biased towards null. At the same time, the direct effect (ie the coefficient on the dummy *female* conditional on including the mediator) will be biased away from null. In other words, in the presence of measurement error the coefficient on the gender dummy would understate the extent to which the mediators explain the fintech gender gap.⁷

One drawback of sequentially adding controls to explain the gap is that the sequencing might affect the results. We thus perform a mediation analysis and decomposition exercise following Gelbach (2016) to assess the impact of each factor. The decomposition provides an accounting that is invariant to the order in which the individual controls are included. Decomposing the overall decline in the coefficient of 6.1 pp (from 8.4 pp to 2.2 pp) into potential mediators shows that individual-level controls account for around 11%, country fixed effects for 10%, and differences in attitudes for 80% of the decline (see Table 4). Further decomposing the overall impact of differences in attitudes shows that attitudes towards technology account for 45% of the overall effect. Differences in price sensitivity and in the suitability of products account for around 27% and 28%, respectively.

In conclusion, the results in Tables 3 and 4 suggest that the gap in the use of fintech is closely linked to differences in attitudes towards technology, as well as price sensitivity and the suitability of products. The fact that the suitability of products and services explains a significant part of the gap could suggest that fintech products do currently not cater sufficiently to the needs of female users. Moreover, while recent results suggest that women are more concerned about implications of data-sharing for their personal safety (Armantier et al., 2021), our findings suggest that concerns about data sharing explain only a small part of the overall gap. We will discuss these aspects, as well as possible drivers of differences in these attitudes, in more detail in Section 4.

3.3. Entrants vs incumbents and substitutes vs complements

This section addresses alternative explanations for the fintech gender gap. The fintech gender gap could arise because women are less willing to adopt new technology, or because women are less willing to

⁷ The Online Appendix provides further details and derives a formula for the bias in the presence of measurement error.

Table 4

Mediation analysis.

Specification	Coefficient estimate
1. Baseline gender gap	−0.0839***
2. Gender gap with all controls	−0.0234***
<i>Mediation – contribution to coefficient change by:</i>	
3. Individual controls	−0.006***
4. Country fixed effects	−0.006***
5. Attitudes	−0.049***

Note: The table shows the results from mediation analysis following (Gelbach, 2016). The *baseline gender gap* in row 1 refers to the unconditional difference in the use of fintech products and services across genders, *gender gap with all controls* in row 2 is the gap resulting from a regression with individual-level controls, country fixed effects and the attitude variables. Rows 3–5 show the contribution to the overall decline in the coefficient from row 1 to 2 by the different potential mediators. *** p<0.01, ** p<0.05, * p<0.1.

Table 5

Fintech entrants and traditional FIs.

VARIABLES	(1) uses FI uses FT	(2) uses no FI uses FT	(3) uses FI	(4) uses FT product	(5) uses FT product
female	−0.075*** (0.008)	−0.034*** (0.005)	−0.071*** (0.006)	−0.017*** (0.001)	
female ×complement				0.009*** (0.001)	0.009*** (0.001)
Observations	13,326	13,777	27,103	514,957	514,957
R-squared	0.178	0.123	0.116	0.091	0.364
Controls	✓	✓	✓	✓	–
Country FE	✓	✓	✓	✓	✓
Product FE	–	–	–	✓	✓
Individual FE	–	–	–	–	✓
Mean of y FE	0.38	0.12	0.49	0.05	0.05

Note: This table reports results for Eq. (1) in columns (1)–(3). The dependent variable *uses FT* is a dummy that takes on a value of one if a respondent has used fintech products offered by fintech entrants over the last six months, and zero otherwise. The dependent variable *uses FI* is a dummy that takes on a value of one if a respondent has used fintech products offered by traditional FIs over the last six months, and zero otherwise. Dummy *female* takes on a value of one if a respondent is female, and zero otherwise. Column (1) restricts the sample to the set of respondents that use fintech products offered by traditional FIs. Column (2) restricts the sample to the set of respondents that do not use fintech products offered by traditional FIs. Column (3) uses the baseline sample. Columns (4)–(5) report results for Eq. (2) at the respondent-product level for 19 distinct fintech products. For each product, the dependent variable *uses FT prod* is a dummy that takes on a value of one if a respondent has used fintech entrants for that product over the last six months, and zero otherwise. Dummy *complement* takes on a value of one for fintech products that complement traditional financial products offered by FIs. *Product FE* denote 19 distinct product-level fixed effects. *Individual FE* denote fixed effects at the respondent level. Each regression includes individual-level controls and country fixed effects and uses robust standard errors, shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

use new providers, even if they would be willing to use the underlying technology. To disentangle these channels, we compare the use of fintech products offered by fintech entrants to those offered by traditional incumbent FIs, which have been ardent adopters of information technology (Ahnert et al., 2022). We also show that the gap is smaller among products that complement familiar financial services, and that it is not due to traditional gender roles within households or differences in financial literacy across genders.

Fintech entrants and incumbent FIs. Fig. 2, panel (b) plots the average share of female (black bars) and male (red bars) respondents that use fintech products offered by traditional FIs and fintech entrants. Three patterns stand out: first, 49% of respondents use novel financial products if they are offered by traditional FIs (average across left-hand bars). Second, the centre and right-hand bars show that respondents using incumbents also use fintech entrants significantly more (35% vs 15% on average). And third, among all groups there is a sizeable gender gap of 9 pp (17% of the mean adoption rate within that group), 8 pp (20% of the mean), and 4 pp (29% of the mean).

To examine these patterns in more detail, columns (1) and (2) in Table 5 split the sample into respondents that have and have not used fintech products offered by traditional financial institutions. Among those that have used incumbents in column (1), the gap averages 7.5 pp; among those that have not, the gap averages 3.4 pp in column (2). While the absolute gap is smaller among those who do not use incumbents, relative to average adoption rates it equals 20% of the mean among those who use incumbents and 28% of the mean among

those who do not. Further, column (3) suggests that men are more likely to use fintech products, irrespective of whether they are offered by fintech entrants or traditional FIs. The dependent variable is the dummy *uses FI*, which takes on a value of one if respondents use fintech products offered by incumbents. The gender gap equals 7.1 pp among products provided by traditional FIs, which is larger than the absolute gap for fintech entrants of 5.2 pp. Yet the difference is statistically insignificant.⁸ Since the gender gap does not differ statistically across providers, the gender gap is likely not specific to *who* provides fintech products, but rather the products themselves (i.e. products relying on novel financial technology).

Substitutes vs complements. The fact that respondents using incumbents also use fintech entrants more could suggest that women might be more willing to use products that complement familiar financial services. This pattern could arise from women's greater risk aversion (Croson and Gneezy, 2009).⁹ To test this hypothesis, we estimate respondent (i) – product (p) – level regressions and introduce an interaction term between *female* and the dummy *complement* that takes on a value of one

⁸ Regressions at the respondent-provider (entrants vs FIs) level yield an insignificant coefficient on the interaction term of *female* with the dummy *fintech* that takes on a value of one if the provider is a fintech entrant.

⁹ Indeed, Auer et al. (2022) show that the more risk-seeking segments of the population (young men) invest most in cryptoassets, a novel asset class.

Table 6
Sub-sample analysis.

VARIABLES	(1) worry sec uses FT	(2) Share data yes uses FT	(3) Dig bank yes uses FT	(4) Literate uses FT	(5) Accounts uses FT	(6) Live alone uses FT	(7) Working uses FT
female	−0.053*** (0.006)	−0.034*** (0.012)	−0.065*** (0.009)	−0.048*** (0.006)	−0.074*** (0.010)	−0.052*** (0.011)	−0.061*** (0.006)
Observations	18,677	6,288	10,047	17,650	7,942	4,095	17,775
R-squared	0.228	0.218	0.198	0.210	0.251	0.199	0.220
Controls	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓
Mean of y	0.26	0.53	0.42	0.22	0.35	0.19	0.31

Note: This table reports results for Eq. (1). The dependent variable is dummy *uses FT*, which takes on a value of one if a respondent has used fintech entrants over the last six months, and zero otherwise. Column (1) restricts the sample to the set of respondents that worries about their security when dealing with companies online. Column (2) restricts the sample to the set of respondents that is willing to share data with fintech entrants for better offers. Column (3) restricts the sample to the set of respondents that is willing to use a digital bank. Column (4) restricts the sample to the set of respondents that has a high literacy score. Column (5) restricts the sample to the set of respondents that has financial accounts at more than three companies. Column (6) restricts the sample to the set of respondents that lives alone. Column (7) restricts the sample to the set of respondents that is employed or self-employed. Dummy *female* takes on a value of one if a respondent is female, and zero otherwise. Each regression includes individual-level controls and country fixed effects and uses robust standard errors, shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

for fintech products that complement traditional financial products offered by financial institutions.¹⁰ Specifically, we estimate the following regression

$$y_{i,p} = \delta_1 female_i + \delta_2 complement_p + \delta_3 female_i \times complement_p + \theta_i + \varepsilon_{i,p}. \quad (2)$$

The dependent variable is a dummy with a value of one if individual i has used a fintech product of type p .

Results in column (4) in Table 5 are consistent with the argument that women are more willing to use products that complement familiar services. It shows that the gender gap is around 50% smaller among complements (0.8 pp) relative to substitutes (1.7 pp), as indicated by the positive and significant coefficient on the interaction term. An added benefit of respondent-product level regressions is that we can exploit the rich within-product variation and include individual fixed effects (θ_i in Eq. (2)). Column (5) shows that the coefficient on the interaction term does not change in any statistically or economically meaningful way when we include fixed effects at the individual level, suggesting that our results are not driven by unobservable respondent characteristics. Note that while the *absolute gap* is twice as large for substitutes relative to complements, the difference in the *relative gap* is less pronounced: with an average adoption rate for substitute products of 6.1% vs 3.4% for complements, the relative gaps equal $(1.7/6.1 =) 27.9\%$ for substitutes and $(0.8/3.4 =) 23.5\%$ for complements.

Robustness tests. Table 6 investigates the fintech gender gap among sub-groups of respondents. The gap is present when we restrict the sample to individuals who worry about the security of their data when dealing with companies online (column 1), or those who would be willing to share their data for better offers (column 2). Column (3) shows that even among those who would be willing to use a digital bank, the gap persists and is close in magnitude to the overall sample. Differences in financial literacy across genders could also affect the use of financial services (Lusardi and Mitchell, 2014). Columns (4) and (5), however, yield a similar gap among those who are confident about planning for their financial future (a proxy for financial literacy) or have more than three accounts with financial companies. Could the gender gap reflect the presence of social norms and traditional gender roles that prescribe a division of labour within households? For example, among married couples, it could be that men are expected to manage the couple's finances (Ke, 2021) and make financial decisions (Kim et al., 2017; Guiso and Zaccaria, 2021). Such traditional gender roles within households could explain women's lower use of fintech. Column (6) shows that the gender gap is also present among individuals who live

alone (5.2 pp). Relative to the average adoption rate, it equals 27% and is similar to the gap in the full sample. This finding suggests that the gap not due to traditional gender roles within households. Finally, column (7) shows that the gap is also present among those who work.

4. Conclusions

This paper has identified a gender gap in the reported use of fintech services. The gap is present in almost every country in our global sample and is not fully explained by country and individual characteristics. Accounting for attitudes towards new financial technology, the suitability of products to users' lifestyle, and the willingness to use fintech entrants if they offer cheaper services, narrows the fintech gender gap significantly.

Differences in attitudes hence seem to lie at the heart of the fintech gender gap. But what could determine differences in attitudes towards new financial technology? Generally, they could be explained by differences in preferences across genders. For example, Croson and Gneezy (2009) provide evidence that women are more risk averse than men, which could explain why women are less willing to adopt new financial technology. Differences could also arise due to gender-based discrimination, for example from bad previous experiences by women with financial institutions (Bartlett et al., 2022; Brock and De Haas, 2022). Finally, differences in attitudes could reflect social norms that affect the cost-benefit trade-off differentially across genders within a society (Falk and Hermle, 2018). For instance, if women have reason to worry more about the consequences of a leak of personal data, then it may be rational to avoid services that require collection and processing of personal data, even if they offer cheaper or better products. Indeed, survey evidence for the US suggests that female respondents are more concerned about implications of data-sharing for their personal safety (Armantier et al., 2021).

Our data do not allow us to fully distinguish between these explanations, but provide suggestive evidence that privacy concerns do not lie at the heart of the observed fintech gender gap. As we show, controlling for whether an individual worries about the security of his/her personal data when dealing with companies online does not narrow the gap. Similarly, we find that the gender gap is present among individuals who live alone, which suggests that explanations that tie the gap to traditional gender roles within households may fall short.

With respect to gender equality, regressions revealed that including county-level controls does not affect our estimates, which suggests that country-level differences in eg gender equality cannot explain the gap. Of course, discrimination varies also across regions or occupations within counties, so our results do not preclude that discrimination plays a role in explaining the gap. Indeed, the fact that the suitability of products and services explains a significant part of the gap could

¹⁰ The Online Appendix provides a detailed list. Fintech products are classified as complements if adoption rates are similar when offered by fintech entrants and traditional FIs.

suggest that fintech products do currently not cater sufficiently to the needs of female users. Such a scenario could arise from a lack of capital flowing into female-founded startups (Hellmann et al., 2019; Hebert, 2020). However, an important aspect to keep in mind when interpreting our results is that the analysis is based on an online survey. To the extent that attitudes and preferences differ between the survey sample and the overall population, our results may not reflect the whole population.

Overall, our results suggest that new technology alone cannot close the gender gap in access to financial services. They also imply that the current gap in access to financial services provided by traditional financial institutions is unlikely to narrow as banks and their services increasingly move towards the digital realm. Policies that aim to enhance financial inclusion through fintech will, however, have to grapple with the reasons for the fintech gender gap. If differences in adoption rates are based on differences in preferences, e.g. in risk aversion, then the scope for interventions through policy is limited. Should the observed outcome be the result of discrimination or social norms and laws that disadvantage women, then policy that addresses and remedies these factors could help to promote financial inclusion through financial innovation.

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Declaration of competing interest

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Data availability

The data that has been used is confidential.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.jfi.2023.101026>.

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