# Female Entrepreneurs, Digital Tools, and Work-Life Balance: Evidence from Small Businesses around the World*

Elizabeth Lyons† Laurina Zhang‡

December 20, 2023

**Abstract**

Using a cross-section of 23,033 small businesses across 42 countries, we provide one of the first empirical investigations of digital technology use among male and female entrepreneurs. We show that there is a digital gender gap but it is not uniform across digital tools; female entrepreneurs use digital tools that support interactions with external stakeholders (i.e., advertising) to the same extent as male entrepreneurs but are less likely to use digital tools for internal firm management activities (e.g., finance), likely due to gender disparity in digital skills. We also find that female founders who face higher levels of non-work related demands, particularly those that start firms in countries without institutional support for work-life conflicts, have a higher intensity of digital tool use.

Key Words: Female Entrepreneurship, Digital Technology Adoption, Work-Life Balance

JEL Codes: J16, J22, L26

*We thank Natalie Carlson, Chris Rider, seminar participants at Boston University, Georgia Tech, Rice University, University of Hawaii, and the University of Utah for helpful comments. All errors are our own.

†School of Global Policy & Strategy, UC San Diego; email: lizlyons@ucsd.edu.

‡Questrom School of Business, Boston University email: laurinaz@bu.edu

# 1 Introduction

Women continue to be underrepresented in entrepreneurship across the world (The World Bank, 2020). Existing research highlights both demand-side and supply-side factors that hinder women's ability to start and sustain businesses, such as gender disparities in accessing financial capital, customers, and markets (Brooks et al., 2014; Ewens and Townsend, 2019; Howell and Nanda, 2019; Guzman and Kacperczyk, 2019).[1] At the same time, digital technologies have significantly reduced entry barriers and the cost of performing various business functions (e.g., Agrawal et al., 2014; Belleflamme et al., 2015; Goldfarb and Tucker, 2019; Greenstein, 2020). Thus, we may expect digital technologies to democratize female entry into entrepreneurship by alleviating frictions that are disproportionately faced by female entrepreneurs in starting a business.

However, the relationship between gender and the likelihood of technology use is not straightforward ex ante. In addition to the firm-specific benefits conferred by digital tools that has been highlighted in prior work (e.g., Athey and Stern, 2002; Baker and Hubbard, 2004; Draca et al., 2007; Brynjolfsson and Saunders, 2010), we argue that they also directly benefit the founder. That is, the use of digital tools provides founders with enhanced capacity to engage with various business activities that simultaneously demand their attention. This additional capacity is not only beneficial for overcoming startups' labor and capital constraints (Gifford, 1992; Hyytinen et al., 2006; Yoo et al., 2016), but it may be especially consequential for female founders that have non-work related constraints, such as household and childcare responsibilities, that further limit the time they can devote to their business (Gurley-Calvez et al., 2009; Alon et al., 2020; Delecourt and Fitzpatrick, 2021; Kepler et al., 2007; Cowan et al., 2023). Thus, female founders may have greater returns from using digital tools in their businesses.

On the other hand, female entrepreneurs may face higher barriers to digital tool adoption than their male counterparts. Existing evidence shows that women tend to use the internet and mobile devices at lower rates (Aruleba et al., 2023; Chen et al., 2023; International Telecommunication Union, 2022), which might suggest that women are also less likely to use other types of technology than men. While few studies have systematically examined barriers to internet and technology adoption, policy reports suggest cultural norms and lack of digital skills may reduce women's participation in the digital economy (OECD, 2018; UNICEF, 2023). Thus, if female entrepreneurs face greater barriers to using digital technology than male entrepreneurs, they may adopt it at lower rates despite having potentially greater returns from using technology, which may exacerbate the existing gender gap in entrepreneurship.

[1] For example, on the demand-side, female founders are more likely to face biases from investors in the evaluation process (Brooks et al., 2014; Ewens and Townsend, 2019); on the supply-side, they are less likely to network with investors (Howell and Nanda, 2019) and tend to start firms with fewer signals of growth orientation (Guzman and Kacperczyk, 2019).

In this paper, we investigate three related questions: 1) Are there gender gaps in digital tool use among entrepreneurs? 2) What might be driving any observed gender disparities in digital tool use? and 3) Do female entrepreneurs' time demands relate to digital tool use?

We take a first step towards answering these questions by examining the use of digital technology by entrepreneurs in small businesses across world. We make progress on these questions in three ways. First, we address the dearth of empirical studies that examine the digital gender gap in terms of technology use by employing novel survey data from a cross-section of 23,033 small businesses with a presence on Facebook in various industries across 42 countries. We document that there is a gender gap in digital technology use in our sample, but that it is not uniform across technology types. Male and female entrepreneurs use external digital tools—those used to manage business activities with external stakeholders, such as advertising and communicating with customers—at similar rates; however, women are significantly less likely to use internal digital tools—those used to manage internal business activities, such as finance and quality control.

Second, we conceptualize and examine potential explanations for the gender gap in internal digital tool use. While a commonly cited reason of the gender gap in the digital economy is differential access to the internet (OECD, 2018; International Telecommunication Union, 2022; Kwakwa, 2023), our sample consists of business owners who have Facebook pages making it unlikely that the observed internal digital tool gender gap is exclusively due to differences in internet access. We also do not find that differences in founding industry and country-level gender inequality, broadly defined, explain the differential internal digital tool use between male and female entrepreneurs. Instead, we find evidence consistent with the interpretation that gender disparities in information, communication, and technology (ICT) knowledge are a driver of the digital gender gap in internal digital tool use.

Third, we investigate whether the founder-specific benefit of digital tools—their time saving nature—differentially relate to their use between male and female entrepreneurs. In particular, we highlight conceptually that the benefits and costs of using technology by female entrepreneurs are impacted by non-work related constraints, such as childcare and household responsibilities. Using founding motivation to proxy for the extent of non-work related demands, we find that women who start firms to meet work-life-balance (WLB) objectives use external digital tools more intensively in their businesses than their male counterparts who also start firms for WLB and women who start firms for other reasons. This relationship is primarily driven by female founders who start businesses in countries where institutional support for childcare and work-life conflicts is relatively low (OECD, 2018; Thébaud, 2015), and thus likely face a greater level of non-work-related demands. In contrast, male entrepreneurs' digital tool use does not differ by whether they

start firms to meet WLB objectives. We document similar, albeit, weaker patterns for the use of internal digital tools.

Taken together, our study shows that the gender gap in digital tool use is not uniform across tool types. In our sample of firms with an online presence, we find the digital gender gap is primarily concentrated in the use of internal digital tools, likely due to differences in ICT knowledge. We also show that non-work related constraints raise the likelihood of female founders adopting digital technology, which mitigates (and in some cases, reverses) the digital gender gap in our setting. This is consistent with interpretation that they confer time saving benefits to the founder, which may be especially valuable for female founders with binding non-work related constraints.

Overall, our study is among the first, to our knowledge, to connect the literature on gender inequality in entrepreneurship to the research on digitization. Our finding that the digital gender gap in entrepreneurship is prevalent across countries even among ventures with online presence suggests a need for interventions directed toward reducing the cost of using digital tools for the internal management of the firm. Given these tools support internal resource allocation decisions, which become increasingly complex as the firm expands, facilitating the use of these types of tools by female founders may contribute to their ability to sustain their firm in the long run. Conceptually, we highlight that digital tools confer benefits to the founder in addition to the firm, and these benefits are particularly salient for female entrepreneurs that face non-work related constraints. Given that an increasing share of female founders cite work-life-balance as a reason to pursue entrepreneurship (Heilman and Chen, 2003; Thébaud, 2015) but spend less time on their ventures than their male counterparts (Gurley-Calvez et al., 2009), our findings provide perspective for thinking about conditions under which technology may reduce or exacerbate existing gender gaps in entrepreneurship.

## 2 Digital Technology, Entrepreneurship, and Gender

Our study is among the first to connect prior work that examines sources of gender inequality in entrepreneurship (e.g. Ding et al., 2006; Guzman and Kacperczyk, 2019; Howell and Nanda, 2019; Bell et al., 2019; Zandberg, 2021; Marx, 2021) to the work in digitization that has examined the consequences of adopting digital technology (e.g. Athey and Stern, 2002; Baker and Hubbard, 2004; Draca et al., 2007; Brynjolfsson and Saunders, 2010; Dranove et al., 2014). In doing so, we provide three main contributions. First, we examine the use of digital technology, which has primarily been studied in the context of improving the productivity of large firms, in the entrepreneurial setting, where female founders have been shown to face disproportionate

challenges in starting a business. Second, we argue that the benefits of digital technology extend beyond the firm to the founder, which may disproportionately benefit female founders that face greater levels of non-work demands. Third, we provide a more nuanced discussion of why the digital gender gap may vary across different types of digital technology.

## 2.1 Firm-specific benefit of digital technology and barriers to female entrepreneurship

Prior work has shown that digitization has reduced search, transaction, and verification costs, which has had major consequences on the economy (Goldfarb and Tucker, 2019; Greenstein, 2020). One consequence is that it improved the productivity of business functions. For instance, digital technologies facilitated identification and communication with employees and customers (Autor, 2001; Kuhn and Mansour, 2014), advertising and sales (Bakos, 2001; Dana and Orlov, 2014), and allowed firms to more easily change their internal organization to improve efficiency (Athey and Stern, 2002; Baker and Hubbard, 2004; Draca et al., 2007; Brynjolfsson and Saunders, 2010) by reducing operating expenses and labor requirements (Agrawal and Goldfarb, 2008; Dranove et al., 2014; Bronsoler et al., 2021). However, most of this work has been in the context of large enterprises. To date, we have limited evidence of the extent to which technology is used in small business settings (Bates et al., 2018; Bar-Gill et al., 2023).[2]

A related second consequence is that digitization has reduced firm entry barriers leading to changes in the composition of products and firms in many markets. For instance, by lowering search costs and aggregating demand from across the world, digitization has allowed greater variety of products to find an audience, including those that received little demand offline (e.g., Brynjolfsson, 2011; Zhang, 2018; Aguiar and Waldfogel, 2018). However, limited work has examined whether it has democratized the entry of traditionally disadvantaged individuals, such as women and minorities, who may face disproportionate challenges in starting and sustaining a business (Coleman, 2009; Cao et al., 2023; Nagaraj and Ranganathan, 2023).

Conceptually, digital technology can reduce the entry barriers associated with starting a business for women in a number of ways. Prior work shows that women are less likely to be funded by investors, often due to discrimination during the evaluation process (Ewens and Townsend, 2019; Hebert, 2020). Technology may alleviate the challenges women face in accessing capital through crowdfunding platforms. Crowdfunding during the initial fundraising stages may not only substitute for traditional sources of capital that are generally lacking for women (e.g., home equity loans), it also expands the number and diversity of potential

[2]Zolas et al. (2021) find that small firms tend to be significantly less technologically sophisticated than large firms.

investors. In addition, it provides potentially better matches through improved information (Agrawal et al., 2014), which may reduce sources of discrimination. Prior work also shows that women are also less likely to network than men (Howell and Nanda, 2019; Cullen and Perez-Truglia., 2023), which can impact their ability to access customers. Given that digital technology allows aggregation of demand across geographic areas, their use may allow female founders to access a larger base of customers than if they were reliant on their local networks to drive sales. Thus, we may expect digital technology to bridge the gap in the ability of female founders to access financial and social capital.

## 2.2 Founder-specific benefit of digital technology

As discussed above, prior work has focused on the firm-specific benefits of adopting digital technology, such as through reduction in entry barriers and increased firm productivity. A key argument we make in our paper is to highlight that technology also confers individual time-saving benefits to the founder. During the startup stage, founders are faced with simultaneous demands on their time, from identifying customers and suppliers to managing operations and finances. Substituting a manual approach for a digitized one allows founders to perform a business activity in less time (e.g., Goldfarb and Tucker, 2019) and allocate attention to other business activities. In the absence of using these types of technologies, founders would have to perform the business function manually, either by themselves, hiring an employee, or outsourcing this function to another firm.[3] The trade-offs founders face in making this decision are impacted by search, hiring, and monitoring costs, and the ability of the entrepreneur to perform the business function on their own, which determines the opportunity cost of their time. At the margin, once the technology adoption cost has been incurred, we argue that using a digital technology to perform a business function saves the entrepreneur the ongoing opportunity cost of performing the function in-house or the cost of outsourcing the task.

We expect this founder-specific benefit of digital tools to be particularly consequential for women who face additional non-work related demands, such as childcare and household responsibilities, that further constrain the time they have for their businesses. Table A1 provides an illustrative example how of the desire to achieve WLB may reflect a need to meet binding non-work responsibilities (i.e., childcare) or a desire to spend time on non-binding non-work activities (i.e., leisure). These distinct underlying motivations for WLB objectives (one reflecting necessity and the other reflecting preferences) may differentially impact

[3]For instance, using a digital technology such as Google Ads or MailChimp allows entrepreneurs to expand the base of customers that are targeted; using digital technology like PayPal expedites handling simultaneous payment across multiple customers; using accounting tools like QuickBooks or Turbo Tax facilitates the management of finances and taxes.

entrepreneurs' ability to meet work demands and, thus, their marginal benefits of adopting time saving technologies. Given prior evidence that women's binding non-work demands continue to be higher than those of men (Gurley-Calvez et al., 2009; Alon et al., 2020; Delecourt and Fitzpatrick, 2021; Kepler et al., 2007; Cowan et al., 2023), female founders may benefit relatively more from the time saving nature of digital tools as they allow these founders them to maintain work productivity while meeting their non-work demands. While non-work responsibilities are commonly viewed as a contributor to the gender gap in broader labor market (e.g., Goldin, 2014; Cowan et al., 2023), our study suggests that they may also increase the relative return of digital tool use in the entrepreneurial setting, where their benefit also confers to the founder.

## 2.3 Digital gender gap across technology types

The above discussion suggests that women may face greater returns to adopting and using digital technology in their businesses, both through reduction of entry barriers and by alleviating time constraints that arise from additional non-work responsibilities. However, policy reports argue that women may face disproportionate barriers in accessing the internet and mobile devices and are less likely to use digital technology (OECD, 2018; UNICEF, 2022). Indeed, Chen et al. (2023) documents a gender gap in the use of fintech products and services across 28 countries and Aruleba et al. (2023) find that female students were slower to adopt remote learning technologies compared to male students during COVID-19 in South Africa. To our knowledge, there has not been a systematic examination of the reasons for differential technology use between men and women, particularly in the entrepreneurial context. Our study aims to contribute to a better understanding of gender gaps in digital technology adoption among entrepreneurs in two ways.

First, we categorize digital tools based on whether they are oriented toward managing business activities with external versus internal stakeholders to assess whether the gender gap is uniform across tool types. This disaggregation allows us to separately analyze gender differences in technology use across different types of digital tools and show that the digital gender gap is not uniform across tool types. Second, we discuss below potential reasons for digital gender gaps among entrepreneurs and examine them empirically in Section 4.

Conceptually, we highlight the trade-offs entrepreneurs perceive when deciding whether to use digital tools. Given that external digital tools are used to conduct business with customers and suppliers (e.g., communication with customers), industry norms may require their use (Gowrisankaran and Stavins, 2002; Ligon et al., 2019) such that information about these tools is also easily accessible for entrepreneurs, especially to those who use the internet.[4] Thus, we expect external digital tools, such as social media like Facebook,

[4]For example, Ligon et al. (2019) show that the low rates of adoption of digital payment tools in India is not due to infrastructure or digital literacy but rather due to demand side factors, such as customers' willingness to use digital payment.

to be widely adopted among all entrepreneurs in our sample and a smaller gender gap in their use.

In contrast, there are several reasons why we might expect a lower rate of internal digital tool adoption by female entrepreneurs. Internal digital tools, which are used to manage the organization of internal firm activities, may encompass a range of business activities, such as human resources, quality control, and financial management. Prior work shows that these business activities are complex management practices that have varied adoption across firms, largely due to information barriers (Bloom et al., 2013; Bloom and Reenen., 2019; Bloom and Van Reenen, 2010). Given this, we expect that digital tools used to perform these functions to be less likely to be adopted by female entrepreneurs, who may be more likely to face informational barriers (Lyons and Zhang, 2017; Manello et al., 2020; Germann et al., 2023) that impact their access and ability to utilize internal digital tools. While prior work does not systematically examine sources of information barriers, policy reports suggest that cultural norms and technology literacy may contribute to women's lower rates of technology use (UNICEF, 2022). For instance, OECD (2018) argues that women's role in the household and broader environment may contribute to their lower rate of technology access. UNICEF (2022)'s recent report highlights that the gender gap in digital skills is substantial across most countries and that technical know-how, such as the ability to use digital devices, communication applications, and networks to access and manage information, is necessary for women to reap the potential socioeconomic benefits of technology.

Another possibility for why internal digital tools may be less used by female entrepreneurs is related to industry founding differences. Prior work shows that men and women tend to work in different sectors, which may be due to preferences, comparative advantage, and gender stereotypes (Heilman, 1983; Hebert, 2020; Kanze et al., 2020; Koning et al., 2020). To the extent that women tend to start firms in industries that are less likely to benefit from internal digital tools, we might expect them to be less likely to use internal digital tools in their businesses. We examine these reasons in the empirical section below.

# 3 Data & Method

## 3.1 Data

Our primary data source is the Facebook Future of Business Survey, a data collection effort conducted by Facebook Data for Good, the World Bank, and the OECD beginning in 2016 with surveys conducted multiple times a year.[5] The surveys are sent to a random representative subset of Facebook business page owners

[5]Survey waves vary from year to year. Surveys are conducted from 2016 to Spring of 2018 were conducted monthly, whereas surveys conducted after Spring 2018 ranged from two to seven times a year.

across 42 countries. This means all respondents have access to the internet and some knowledge of digital technologies. All survey respondents in our sample are firm owners and 85% are founders.[6]

The main limitation of the survey is that the data is not longitudinal and we are not able to track entrepreneurs over time.[7] In addition, survey waves have different survey questions depending on partner objectives. We focus on the survey waves from 2017 to 2018, where the survey questions remained the same and we have data on our key variables of interest. In total, we have a cross section of 23,033 small businesses across two years.

It is also worthwhile to note that while our sample is representative of Facebook page business owners in each country, it may not be representative of each country's business population in general.[8] Given the low cost of creating a Facebook page and the ubiquity of Facebook around the world during our sample period,[9] we expect that most small to medium sized firms that conducts any amount of marketing to have a Facebook page in many countries.[10] However, one might be concerned that in some countries, for example where internet access is low, a large share of small to medium-sized businesses do not have Facebook business pages such that our sample may not be broadly representative of active businesses in these countries. However, as we are interested in the gender gap in digital use, we are interested in the relative use of digital tools by male and female entrepreneurs within a country rather than digital tool use by entrepreneurs on average. Thus, to the extent that we document a gender gap among businesses with an online presence, we expect the digital gender gap to be at least as large in the non-Facebook population.[11] One of the main benefit of our dataset is that by restricting attention to businesses with Facebook pages, we are able to rule out the most commonly discussed contributor of the digital gender gap—lack of internet access.

[6]The remainder inherited the business from family members (5%), purchased the business from someone else (5%), or acquired it from some other means (5%).

[7]Respondents are not re-sampled across survey waves, and, thus, it is very unlikely that the same business is surveyed more than once.

[8]Facebook has a considerable amount of information about respondents and non-respondents that allows them to construct non-response weights using an inverse-probability weighting approach (IPW). Specifically, they use a logistic regression to predict the probability of response given eligibility for the survey (i.e. being in their target population of small to medium business owners with a Facebook page). While they have a good sense of the demographics of non-Facebook business leaders might be by industry, gender, or age for certain countries, they do not have this data in many countries. Moreover, in countries where such data are present, they are often not comparable across countries. See Schneider (2020) for more details on the sampling methodology.

[9]For instance, see https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/digital%20globalization%20the%20new%20era%20of%20global%20flows/mgi-digital-globalization-full-report.ashx and https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/.

[10]Facebook business pages are marketed by Meta as tools to increase visibility with customers (https://www.facebook.com/business/help/461775097570076?id=939256796236247).

[11]To address the concern that our sample may not be representative of businesses in countries with low internet access (and hence lower Facebook use), we show that the digital gender gap for internal digital tools is statistically similar in both high and low internet access countries in Appendix Table A3 using data from the World Bank (https://data.worldbank.org/indicator/IT.NET.USER.ZS).

### 3.1.1 Dependent variables

Table 1 provides summary statistics of the key variables. Our main outcome variables of interest are the use of digital tools. In particular, we disaggregate digital tools into two types: *external digital tools*—those used to connect with stakeholders outside of the firm, such as technologies used to provide information, show products/services, sell products/services, communicate with customers or suppliers, and advertise to potential customers;[12] and *internal digital tools*—those used to manage internal business activities, such as technologies used to manage finances, taxes, inventory, and communicate within the firm. For example, digital tools used for managing external activities may include digital payment services like PayPal, advertising tools like Google Ads, and marketing campaign tools like MailChimp; digital tools used to manage internal business activities include project management platforms like Monday.com, and accounting tools like QuickBooks.

Given that firms in our sample all have Facebook business pages, which is predominantly used to connect with customers, it is unsurprising that almost all of the firms in our sample use digital tools to manage at least one external business activity. Out of the five possible external uses of digital tools listed above, firms, on average, use digital tools to manage four (mean = 3.7) parts of their external business activities. Thus, to capture meaningful variation in external tool use, we define *External digital tool use* as a binary variable that is equal to one if the firm uses a *high* degree of external digital tools; that is, for at least four business activities.[13] *Internal digital tool use* is a binary variable that is equal to one if the firm uses internal digital tools, and zero otherwise.[14] In our sample, 56.2 % of firms have a high rate of external digital tool use, while 22.5% of firms use internal digital tools.

### 3.1.2 Independent variables

We define a firm as a *Female firm* if more than 50% of owners/founders are female. About 44% of firms in our sample are female owned.

Our measure of non-work related demands is based on whether founders report their primary founding motivation is to meet work-life-balance (WLB) objectives. We argue that founders who report they started their firm for WLB are likely to have non-work activities that they would like to prioritize relative to those who start their firm for other reasons, such as to have a source of income. While WLB motivations

[12]The survey asks respondents to select the business functions for which they use digital tools.

[13]Our results are similar if we use indicators for each type of external tool as outcomes rather than our preferred measure of external tool use intensity.

[14]The survey question asks if respondents use digital tools for internal business processes (e.g., finance, communication within the firm), and thus we do not have measures that capture the use of distinct types of internal digital tools.

may reflect binding non-work responsibilities (e.g., childcare) or preference for leisure activities, existing evidence shows that a motivation for entry into entrepreneurship increasingly cited by women is the belief that self-employment better allows them to balance their work and home activities relative to traditional employment. This suggests that WLB motivations among female founders are more likely to reflect non-work responsibilities rather than a preference for leisure time (Gurley-Calvez et al., 2009; Heilman and Chen, 2003; Thébaud, 2015; Rose, 2018). In our sample, we also find that women are significantly more likely to select achieving WLB as their primarily founding motivation compared to male entrepreneurs (28% vs. 25%, p=0.000). Since respondents are permitted to select up to three founding motivations, we construct the *Founded for WLB* measure by weighing it by the number of motivations selected.

The richness of our cross-country variation allows us to examine what might be driving the digital gender gap. As discussed in Section 2.3, we examine whether the digital gender gap is more pronounced in countries with cultural norms that may prevent equal access to technology and in countries where there are greater gender disparity in digital skills that may hinder female founders from recognizing the value of digital technology and implementing them in their businesses (OECD, 2018; UNICEF, 2022). While it is difficult to proxy for cultural gender norms, they affect and are shaped by a country's institutional, political, economic, and health factors that contribute to female equality in economic and social participation. Thus, we use a country-level index for gender equality created by the World Economic Forum[15] to proxy for cultural norms around gender. The gender equality score for each country ranges from 0 to 100 and is based on women's economic participation and opportunity, educational attainment, health and survival, and political empowerment. Countries in our sample score between 0.55 to 0.79, with an average of 0.72.

To proxy for gender disparity in digital skills, we use data from the OECD[16] on the share of female tertiary school graduates majoring in ICT in 2015. Tertiary degrees in ICT include fields such as in informatics, computer science, multimedia, and programming.[17] Because this data is from the OECD, it is available for 22 (or 57%) of the countries in our sample. On average, the share of female graduates with an ICT major in our sample is 22.6%.

We also further examine non-work related demands based on whether firms are started in countries with low institutional support for managing work-life conflicts. We capture these countries based on the level of female labor force participation. The OECD argues that government policies that help parents achieve work-life balance, such as the provision of childcare leave, are key determinants to female participation in

[15]Source: https://www.weforum.org/publications/the-global-gender-gap-report-2017
[16]Source: https://stats.oecd.org/index.aspx?queryid=108601
[17]https://stats.oecd.org/index.aspx?queryid=108601.

the labor force (OECD, 2018). This is consistent with research that shows women are less likely to pursue entrepreneurship and more likely to participate in the traditional labor market in contexts where there are institutional policies that mitigate work-life conflicts (Thébaud, 2015). Thus, we expect female entrepreneurs who start their firm to meet WLB in countries with lower female labor force participation to face higher barriers in meeting their non-work demands, and thus, have greater returns to using digital tools in their business, all else equal. We use measure female labor force participation using data from the World Bank.[18]

#### 3.1.3 Control variables

We include controls for a host of firm-level characteristics that may separately impact digital tool use, including firm size, age, whether they have received venture capital (VC) financing, and whether the firm faces an above sample average number of business challenges. The majority of businesses in our sample are quite small and hence it is reasonable to infer that the founder/owner is the one of key decision makers of whether and how technology is used within the firm (DeLone, 1988). About 42% of firms have no hired employees (founder only), 49% have between 2 and 9 hired employees, 7.3% have 10 to 49 employees; and only 1.3% of businesses have more than 50 employees. Almost half of the firms are younger than three years. Consistent with VC investment being a low likelihood event for start-ups in general (e.g. Catalini et al., 2019), only 3.8% of firms in our sample have received VC financing. On average, firms report facing four out of the fourteen possible business challenges, which include challenges such as finding customers or suppliers and securing financing. About 40% of the firms in our sample report facing an above sample average number of business challenges.

### 3.2 Empirical Strategy

As discussed above, our first line of inquiry is to examine whether there are gender gaps in digital tool use among entrepreneurs. Our main estimating equation is as follows:

$$Y_i = \alpha + \beta_1 \text{FemaleFirm}_i + X_i + Industry_i + Country_i + SurveyYear_i + \varepsilon_i, \quad (1)$$

where $Y_i$ measures the extent of firm $i$'s use of external or internal digital tools. As discussed in Section 3.1, *External digital tool*, captures whether firm $i$ has an above average rate of external digital tool use; *Internal digital tool* captures whether firm $i$ uses internal digital tools. *Female Firm*$_i$ is an indicator variable equal to

[18]Data source: https://data.worldbank.org/indicator/SL.TLF.ACTI.FE.ZS

one if firm $i$ is female owned, and zero otherwise. Thus, $\beta_1$ estimates the differential use of digital tools by female-led firms. We control for a variety of firm level characteristics ($X_i$), including firm size based on the number of employees, whether the firm was founded in the last three years, whether the firm has received VC financing, and whether the firm reports an above median number of major business challenges. We also control for industry, country, and year fixed effects. Industry and country fixed effects control for systematic differences across sectors and regions that may separately affect digital tool use (e.g., if firms founded in media and communications sectors have a higher tendency of using digital tools; if certain countries have better digital infrastructure that facilitate greater digital tool use). Year fixed effects control for the possibility that survey questions are interpreted differently across the two survey waves, for instance, due to macroeconomic conditions.

The main empirical challenge is that there are unobservable differences across founders and firms that may lead to differential patterns of digital tool use between male and female entrepreneurs that are *unrelated to differential underlying costs and benefits to adoption.* For instance, female founders may optimally adopt fewer digital tools because they start businesses that are less likely to benefit from them. Thus, we begin by descriptively documenting whether there is a gender gap in digital tool use and then turn to an investigation of possible reasons of any observed gender gaps.

We are also interested in whether non-work related demands relate to differential digital tool use between male and female entrepreneurs, which is estimated by equation 2 below.

$$Y_i = \alpha + \beta_1 \text{FemaleFirm}_i + \beta_2 \text{Founded for WLB}_i + \beta_3 \text{Female}_i \times \text{Founded for WLB}_i + X_i + Industry_i + Country_i + SurveyYear_i + \varepsilon_i, \quad (2)$$

*Founded for WLB* is a weighted measure of whether the founder of firm $i$ indicated they started their firm to achieve WLB. Thus, $\beta_3$ estimates the differential relationship between digital tool use and female entrepreneurs who started their firm to meet work-life demands.

# 4 Results

## 4.1 Digital gender gap in tool use among entrepreneurs

We start by examining average digital tool use across male and female entrepreneurs. Figure 1's Panel A and B plot the average tool use by male and female entrepreneurs for external and internal digital tools, respectively. Panel A shows that, for most countries, the extent of external digital tool use by male and female founders is similar (i.e., close to the 45 degree line). In contrast, Panel B shows that female entrepreneurs use internal digital tools at lower rates than male entrepreneurs in almost all countries in our sample, and there is no country in which female use of internal tools is significantly higher than male use.

Table 2 confirms these patterns in regression analyses. Columns 1 and 2 examine female entrepreneurs' likelihood of using a high degree of external digital tools and whether they use internal digital tools, respectively.[19] They show that, while male and female entrepreneurs are similarly likely to use a high degree of external digital tools, women are significantly less likely (about 2 percentage points or 8%; p-value $< 0.01$) to use any internal digital tools, controlling for differences in firm (e.g., firm size, receipt of VC funding, and the number of business challenges they report facing), industry, and country characteristics. Thus, while policy reports typically refer to the digital gender gap with respect to ICT broadly (OECD, 2018), our findings suggest that, among businesses with an online presence, the gender gap in digital tool use among entrepreneurs is primarily concentrated in the use of internal digital tool.

## 4.2 Digital gender gap for internal digital tools: possible explanations

As discussed in Section 2.3, the above findings are consistent with the interpretation that male and female entrepreneurs in our sample face similar net benefits of using external digital tools, likely because these tools are relatively easy to adopt, and their use (i.e., to communicate and conduct business with external stakeholders) may be driven by industry norms and demand-side expectations (Gowrisankaran and Stavins, 2002; Ligon et al., 2019). As a result, we do not find any differences between male and female entrepreneurs in their intensity of external digital tool use. In contrast, the net benefits from internal digital tool use may be lower for female entrepreneurs than for male entrepreneurs for several reasons.[20] While we are not able to pinpoint causal reasons that lead to a lower rate of internal digital tool use by female entrepreneurs, we

[19] As discussed in Section 3.1, the dependent variable *External digital tool* captures whether firms use external digital tools for an above average number of business functions.

[20] While the predominant explanation for lower rates of female participation in the digital economy is the relative lack of internet access by women (OECD, 2018; UNICEF, 2023) given our sample consists of entrepreneurs that have Facebook pages, it is unlikely that lack of internal digital tool use is primarily explained by differences in internet access.

explore possible (and not-mutually exclusive) explanations below.[21]

**Differences in founding industries.** One possibility is that women may tend to start firms in industries that are less likely to require or benefit from internal digital tools compared to male founders. Indeed, Table A2 shows that there are significant differences in founding industries between male and female entrepreneurs; men tend to start firms in sectors such as manufacturing, construction, media and communication, whereas women tend to start firms in sectors such as retail, healthcare, and personal services.[22] We investigate this interpretation by splitting the sample by industries in which digital tools are more and less likely to be used in Table 3. If women are less likely to use internal digital tools on average because of lower benefits independently of adoption costs, then we should expect them to have similar rates of use in sectors that require internal tools to conduct business, such as accommodation (e.g., hotels) and professional services (e.g., financial services). Table 3 demonstrate that in both high and low internal tool requirement industries, female entrepreneurs are equally *less* likely (p-value $< 0.05$) to adopt internal tools than male entrepreneurs (columns 3 and 4). This suggests that the gender gap in internal tool usage is not primarily driven by industry founding differences.

**Differences in firm characteristics.** Related to the above, another possible explanation for the differences in internal digital tool use across male and female-led ventures may be due to differences in firm characteristics. For instance, if female firms tend to be less focused on firm growth (Coleman, 2009), they may perceive their firms to be less likely to benefit from capital expenditures such as digital technologies, particularly ones that may be more complex and expensive to use. To the extent that this lower tendency to make capital investments is more pronounced when firms are in the earliest stage of growth, Appendix Table A4 shows that the internal digital tool gap is statistically similar across firms with employees and those that are comprised of only the founder. In addition, the inclusion of firm size and age controls mitigate some of these concerns.[23]

More broadly, we also formally examine the extent to which unobservable differences between female and male founded ventures—such as firm quality not captured by size, VC investment, the number of

[21] Understanding the reasons for differential digital tool use between male and female founders have implications for firm performance and policy. For example, if differences in male and female founder digital tool use are due to differences in founding industries, we may be less likely to conclude the lower rates of tool use by female founders to be sub-optimal adoption. In contrast, if we find that differential use is associated with technology literacy, that suggests there is an opportunity to close the gender gap by improving digital skills of female founders.

[22] Prior work shows a variety of reasons that contribute to occupational gender segregation—the tendency for men and women to work in different sectors—which may be due to preferences, comparative advantage, and gender stereotypes (Heilman, 1983; Hebert, 2020; Kanze et al., 2020; Koning et al., 2020).

[23] We also verify that our estimates are unchanged by the inclusion of an additional control for firm quality—whether the entrepreneur evaluates the current state of their business as positive. While inclusion of this control does not change our main estimates, we do not include this control throughout our main regressions because it is not obvious whether it captures the entrepreneur's innate optimism or actual firm performance.

challenges they face—are driving the gender gap in internal digital tools using Oster (2019)'s bounding method. The intuition underlying this analysis is that, in cases where observed controls share covariance with unobservables, the quality of the controls will be diagnosed by the stability of the coefficient and by the movement in R-squared when the observable controls are included. In Table A5, we find that the bias-adjusted coefficient is only slightly smaller than our estimated coefficient and unobservables would need to be over four times more important than the observable controls to eliminate the significant negative relationship between female firms and internal digital tools.[24]

**Informational barriers.** A not-mutually exclusive explanation to the above is that female entrepreneurs may face greater informational barriers that prevent them from understanding the benefits of internal digital tools and how they may be implemented in their business. As discussed in Section 2.3, while gender-based information barriers may arise for a variety of reasons, policy reports suggest two primary reasons may be cultural norms and lack of digital skills (OECD, 2018; UNICEF, 2023). In Table 4, we explore these potential sources of information barriers. In Panel A, we split countries by The World Economic Forum's index for gender equality.[25] While cultural gender norms are complex and difficult to capture empirically, they likely correlate with the extent to which women face barriers in accessing information and resources that affect their social and economic outcomes, which may include internal digital technology. Interestingly, we find that the gender gap in internal digital tool usage persists even in countries that are relatively more gender equal (p-value $< 0.05$ in columns 3 and 4) and presumably have fewer structural cultural barriers that prevent equal access to technology.

In Panel B, we examine the extent to which digital skills contributes to the internal digital tool gap by splitting countries based on the share of female post-secondary graduates with majors in ICT. We find that countries with high gender inequality in ICT education (i.e., a lower share of female ICT graduates) is correlated with a larger gender gap for internal digital tool use.[26] In particular, column 4 demonstrates that female firms in countries with larger gender gaps in ICT education are 3 percentage points less likely to use internal digital tools (p-value $< 0.01$) whereas the relationship between female firms and internal tool use is statistically insignificant in countries with smaller gender gaps in ICT education (column 3).

Taken together, our findings suggest that closing the gender gap in digital skills may contribute to increasing the use of internal digital tools by female founders, particularly since our sample consists of founders that have an online presence and presumably have higher levels of digital literacy compared to the

[24] See Oster (2019) for more details.

[25] As discussed in section 3, this measure is constructed based on key socioeconomic dimensions, such as women's economic participation and opportunity, educational attainment, health and survival, and political empowerment.

[26] We verify that the pattern in Panel A holds with the same sample used for Panel B.

broader population. Given internal digital tools become more important as firms scale and contribute to managing firms' internal resource allocation (e.g., finance, inventory, human resources etc.), increasing their use may help improve survival and firm performance of female-led firms. More broadly, our findings in Table 4 highlight that understanding the contributors of the digital gender gap requires looking beyond composite measures of gender inequality. While such composite measures capture important dimensions of economic and social participation, they do not capture or necessarily correlate with inequality in digital skills.

### 4.3 Digital gender gap in digital tool use and non-work related demands

Thus far, we have documented a digital gender gap in internal digital tool use that is associated with gender disparities in technology literacy. In this section, we explore the relationship between non-work related demands and entrepreneurs' usage of digital tools, and whether this relationship varies by gender. As discussed in Sections 2.1 and 2.2, we highlight that in an entrepreneurial setting, digital technology not only confers firm-specific benefits but also alleviates time constraints of the founder. We argue that these benefits may be particularly valuable for female founders that have additional non-work related demands that further constrain the time they can devote to their businesses.

As discussed in Section 3.1, we capture non-work-related demands based on whether a founder started their firm primarily to balance work-life objectives. Figure 2 plots the raw means of external (Panel A) and internal (Panel B) digital tool use for male and female entrepreneurs split by those that start their firm to meet WLB objectives. Table 5 presents the corresponding regression results. Several patterns emerge. First, Panel A of Figure 2 shows that female firms founded for WLB use external digital tools to a *greater* extent compared to their male counterparts who found firms for WLB and their female counterparts who do not start firms for WLB. In contrast, male entrepreneurs who start firms for WLB are not significantly more likely to use external tools compared to those who start firms for other reasons. These findings are consistent with the interpretation that, while WLB founding motivations may capture higher non-work activities relative to those who select other founding motivations, they are less likely to reflect binding non-work constraints for male entrepreneurs compared to female entrepreneurs. Consequently, male entrepreneurs who start their firms for WLB do not significantly raise their likelihood of using digital tools in their business to alleviate time constraints, in contrast to female entrepreneurs with similar founding motivations. Column 1 of Table 5 confirm these patterns in regression analysis—while male and female founders do not differ on average in their intensity of of external digital tool use, female founders who start firms to balance work-life demands are disproportionately more likely to use external digital tools (p-value $< 0.10$).

To further examine the extent to which non-work related demands related to digital tool use, Figure 3 and columns 2 and 3 of Table 5 split the sample by entrepreneurs who start their firm in high and low female labor force participation countries, respectively. Columns 2 and 3 (and Panel A of Figure 3) show that the disproportionately higher use of external digital tools by women who start firms to achieve WLB in column 1 is largely driven by female entrepreneurs in low female labor market participation countries. Whereas the overall likelihood of external digital tool use does not significantly differ between male and female entrepreneurs who start firms for WLB in high female labor market participation countries (column 2),[27] in countries with low female labor market participation (column 3), the overall likelihood of external tool use by female entrepreneurs who start firms for WLB is significantly *higher* than the two groups that likely face lower levels of non-work demands: their male counterparts who value WLB and their female counterparts who start firms for other reasons.[28] Combined, these results show that female entrepreneurs use external digital tools more intensively in their businesses when they face non-work related demands, which are heightened in countries that have less institutional support for managing non-work related responsibilities.

Columns 4 to 6 and Panel B of Figures 2 and 3 show that these patterns are similar but less stark for internal digital tools. Similar to the finding in Table 2, female entrepreneurs who start firms for WLB are still significantly less likely to use internal digital tools than their male counterparts (column 4), which underscores the challenge of adopting this type of digital tool. Similar to external digital tools, male entrepreneurs' internal technology use is not significantly related to WLB motivations. However, Panel B of Figure 3 and column 6 show that in low female labor market participation countries, women with WLB motivations are *equally* likely to use internal digital tools as their male counterparts.[29] Thus the gender gap for internal tool use that we found in Table 2 is mitigated among entrepreneurs motivated by WLB in countries with less institutional support for managing work-life conflicts. These findings suggest that while the rate of internal tool use is lower for women on average, facing non-work related time constraints raises female entrepreneurs' likelihood of using them in their businesses.

Taken together, the above results highlight the founder-specific benefit of digital technology in alleviating time constraints is particularly consequential for female founders that face non-work related constraints. Female entrepreneurs are more likely to use digital tools in their businesses when they face heightened non-work related demands. This relationship is particularly pronounced for external digital tools for which female entrepreneurs face fewer adoption barriers, particularly in our setting. These patterns are in contrast to male

[27]The p-value of $FemaleFirm + FemaleFirmxWLB = 0$ is 0.772.
[28]The p-value of $FemaleFirm + FemaleFirmxWLB = 0$ is 0.008; the p-value of $WLB + FemaleFirmxWLB = 0$ is 0.011.
[29]The p-value of $FemaleFirm + FemaleFirmxWLB = 0$ is 0.324.

entrepreneurs whose technology usage decisions appear less correlated with WLB objectives, suggesting that WLB goals among male founders are less likely to reflect binding time constraints than they do among female founders.

# 5 Conclusion

Our analysis of the use of digital technology in small businesses shows that the digital gender gap is not uniform among businesses that have an online presence but instead varies by technology type. Specifically, we find that men and women do not differ in their intensity of digital tool use for managing business activities that involve external stakeholders (e.g., sales and marketing), but that women are significantly less likely to use digital tools to manage internal business activities (e.g., finance). We do not find evidence that this gender gap in internal tool use is due to industry founding differences or broad differences in gender inequality. Instead, we find evidence that suggests differences in digital skills may preclude female founders from understanding the benefits of deploying technology for the management of internal firm activities and how to implement them. In addition, we show that women are more likely to use digital tools when they face non-work related demands, measured by those who start their firm primarily to balance work-life objectives, especially those that face these demands in low female labor force participation countries. By contrast, we do not find evidence that male entrepreneurs significantly increase their technology use based on whether they start firms to balance work-life objectives.

Our findings provide two main implications. First, they highlight that the benefits of digital technology extend beyond the productivity benefits they confer to the firm to supporting time-constrained entrepreneurs in managing their work and non-work related demands. Given that women increasingly cite work-life-balance as a key challenge in their participation in the traditional labor market and that an increasing share of female founders cite balancing non-work demands as their reason to pursue entrepreneurship (Heilman and Chen, 2003; Thébaud, 2015), our findings highlight the role that technology can play in alleviating the gender gap in entrepreneurship. However, these benefits may not be realized if women are unable to adopt digital tools. Beyond female founders, the individual-specific benefit conferred by digital technology may be especially valuable in the early-stages of a startup when founders face particularly high demands on their time and in markets where there are frictions to conducting business activities (e.g., selling niche products).

Second, our study sharpens the policy discussion around how the digital gender gap can be reduced. While much of the current discussion suggests that equitable internet access can improve female participation

in the digital economy, our study suggests that internet access is a necessary but likely insufficient condition to facilitating technology use. Instead, our disaggregation of the digital gender gap by technology types illustrates that technology literacy, which is typically not captured by indices for gender equality, likely plays an important role in contributing to the digital gender gap, particularly for those types of technology with higher adoption costs. In light of recent reports that show there are significant gender disparities in digital skills even in countries that are considered gender equal on other metrics (UNICEF, 2022), our finding suggest that interventions aimed at improving gender equality in the digital economy should be directed towards educating girls and women on the benefits and use of internal digital tools, such as financial technology. For example, entrepreneurial training programs, that have been shown to disproportionately benefit women (e.g., Lyons and Zhang, 2017), may be one such intervention for reducing barriers to the use of these types of digital tools among female founders. More broadly, our study provides perspective for thinking about the extent to which technology may alleviate or exacerbate existing gender inequalities in high growth settings.

Our work has several limitations. First, we do not observe performance outcomes of these firms aside from VC investment and entrepreneurs' own claims about business challenges. Combined with the cross-section nature of our data, this precludes us from examining whether digital tool use impacts the survival and performance of female ventures. We believe that understanding how different types of digital technologies can affect resource allocation decisions and performance of female and male-owned ventures is a promising avenue for future research. In addition, while our findings suggest that the gender gap for internal digital tool use is likely due to differences in technology literacy, there may be other reasons that contribute to differences in technology use. Shedding light on the sources of adoption costs for internal digital tools across sectors and countries would offer important firm and policy insights. Finally, our sample provides useful perspective for thinking about the boundary conditions of digital tool use. Given every founder in our sample uses digital technology to some extent, our sample consists of female entrepreneurs who are likely more familiar with technology than the average female founder. This suggests that they are better able to adopt and use digital technology when faced with time constraint compared to the broader population. It also suggests our estimated digital gender gaps may be lower bounds of what exists in the broader population.

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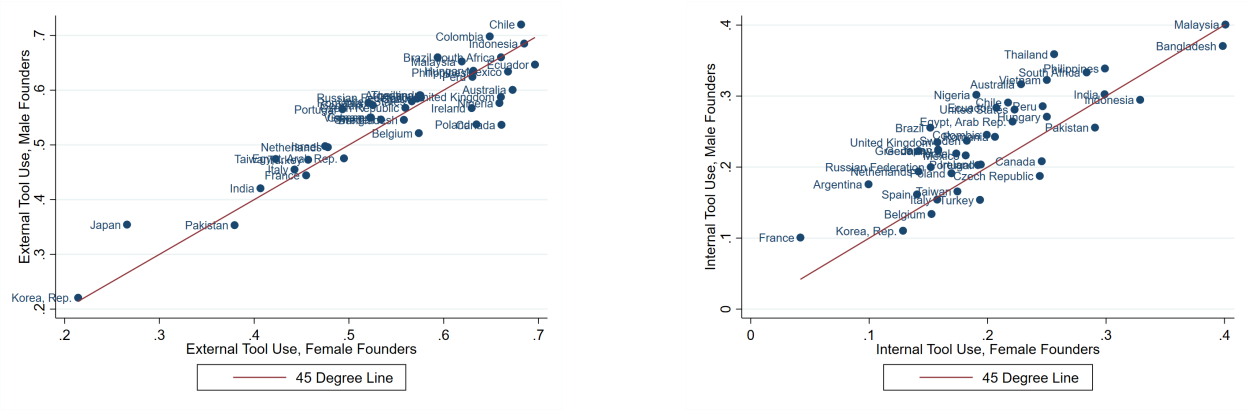
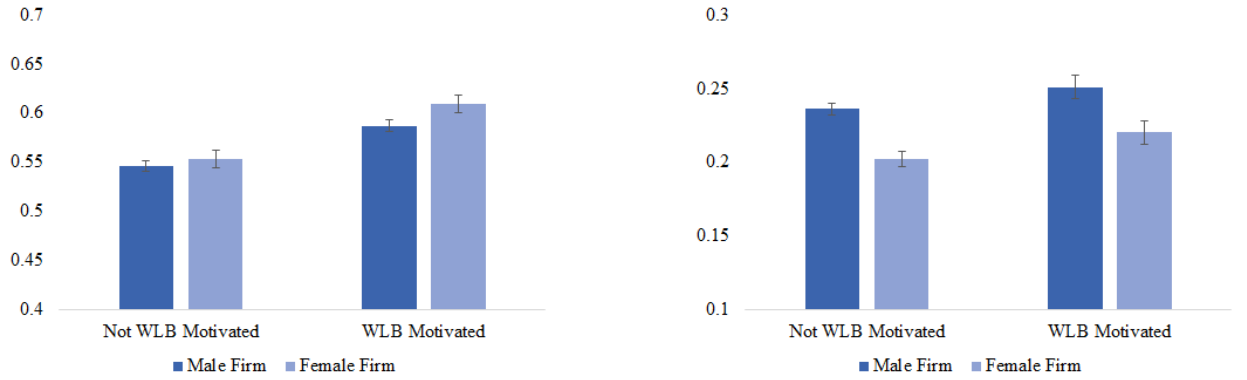
## Figure 1: Digital tool use, by country




**(a) External digital tool use** **(b) Internal digital tool use**

*Note*: These figure plots the average use of digital tools for male (y-axis) and female (x-axis) entrepreneurs in each country. Panel A presents average external digital tool use and Panel B presents average internal digital tool use. Points close to the 45 degree line suggests male and female entrepreneurs adopt digital tools at equal rates in a country.

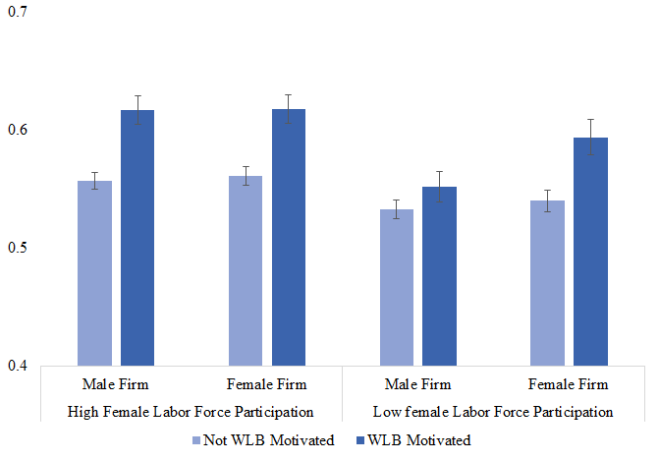
## Figure 2: Digital tool use, by gender and WLB founding motivation



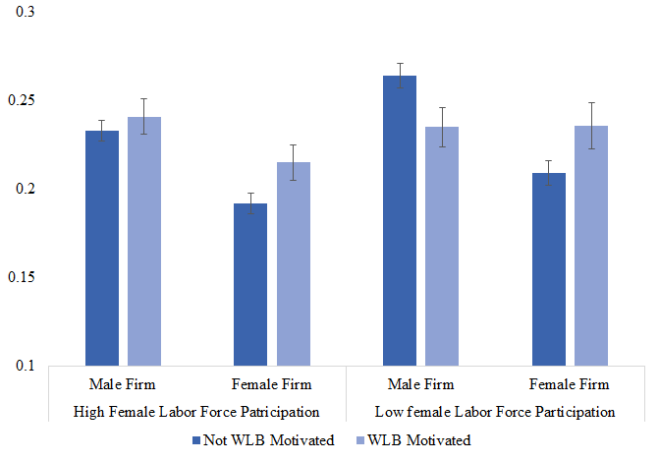

**(a) External digital tool use** **(b) Internal digital tool use**

*Note*: These figure plots the average use of digital tools for male (dark shade) and female (light shade) firms split by entrepreneurs who founded the firm to achieve WLB and those who founded the firm for other reasons. Panel A presents average of those with with a high rate of external digital tool use and Panel B presents the average rate of internal digital tool use. Black bars present standard errors.

**Figure 3: Digital tool use by gender, WLB founding motivation, and female labor force participation**




**(a) External digital tool use**




**(b) Internal digital tool use**

*Note*: These figure plots the average use of digital tools for male (dark shade) and female (light shade) firms split by entrepreneurs who founded the firm to achieve WLB and across countries with above and below sample median female labor force participation. Panel A presents average of those with a high rate of external digital tool use and Panel B presents average internal digital tool use. Black bars present standard errors.

**Table 1: Summary statistics**

| | Obs | Mean | Std. Dev. |
|---|---|---|---|
| *Outcomes:* | | | |
| External digital tool | 23,033 | 0.562 | 0.496 |
| Internal digital tool | 23,033 | 0.225 | 0.418 |
| *Explanatory variables:* | | | |
| Female firm | 23,033 | 0.439 | 0.496 |
| Founded for WLB | 23033 | 0.102 | 0.185 |
| *Controls*: | | | |
| Founder only | 23,033 | 0.425 | 0.494 |
| 2-9 employees | 23,033 | 0.489 | 0.500 |
| 10-49 employees | 23,033 | 0.073 | 0.261 |
| 50+ employees | 23,033 | 0.013 | 0.114 |
| Young firm (under 3 years) | 23033 | 0.499 | 0.500 |
| VC financing | 23,033 | 0.038 | 0.192 |
| High number of challenges reported | 23,033 | 0.400 | 0.490 |

**Table 2: Digital gender gap in tool use**

| | (1)<br>External digital tool | (2)<br>Internal digital tool |
|---|---|---|
| Female firm | 0.006 | -0.019 |
| | (0.007) | (0.006) |
| Founder only | -0.009 | -0.172 |
| | (0.027) | (0.032) |
| 2-9 employees | 0.032 | -0.083 |
| | (0.027) | (0.032) |
| 10-49 employees | 0.049 | -0.006 |
| | (0.032) | (0.031) |
| Young firm | 0.041 | 0.012 |
| | (0.008) | (0.005) |
| VC financing | -0.039 | 0.050 |
| | (0.017) | (0.018) |
| High number of challenges | 0.236 | 0.141 |
| | (0.010) | (0.011) |
| Observations | 23,033 | 23,033 |
| $R^2$ | 0.097 | 0.080 |

*Note*: OLS regressions. The dependent variable of column 1 is a dummy variable indicating whether the firm reports using a high degree of external digital tools (i.e., for an above average number of business functions), and the dependent variable of column 2 is a dummy variable indicating whether the firm reports using internal digital tools. All specifications include industry, country, and year fixed effects. Standard errors clustered at the country level.

**Table 3: Digital gender gap, by industries with high internal digital tool usage**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | External digital tool | | Internal digital tool | |
| | High internal tool benefit | Low internal tool benefit | High internal tool tool benefit | Low internal tool benefit |
| Female firm | -0.000 | 0.008 | -0.026 | -0.017 |
| | (0.011) | (0.009) | (0.010) | (0.007) |
| Observations | 7822 | 15211 | 7822 | 15211 |
| $R^2$ | 0.102 | 0.098 | 0.080 | 0.079 |

*Note*: The dependent variable of columns 1 and 2 is a dummy variable indicating whether the firm reports using a high degree of external digital tools (i.e., for an above average number of business functions), and the dependent variable of columns 3 and 4 is a dummy variable indicating whether the firm reports using internal digital tools. Columns 1 and 3 include the subsample of industries with above sample median internal digital tool use and columns 2 and 4 include the subsample of industries with equal to or below sample median internal digital tool use. All specifications include the firm-level controls included in Table 2, industry, country, and year fixed effects. Standard errors clustered at the country level.

## Table 4: Digital gender gap, by country-measures of inequality

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | External digital tool | | Internal digital tool | |
| | Low Inequality | High Inequality | Low Inequality | High Inequality |
| **Panel A: Gender inequality** | | | | |
| Female firm | 0.015 | -0.011 | -0.016 | -0.025 |
| | (0.011) | (0.007) | (0.007) | (0.010) |
| Observations | 13169 | 9864 | 13169 | 9864 |
| $R^2$ | 0.070 | 0.134 | 0.078 | 0.081 |
| **Panel B: Share of female graduates in ICT** | | | | |
| Female firm | 0.005 | 0.010 | -0.003 | -0.030 |
| | (0.019) | (0.015) | (0.012) | (0.009) |
| Observations | 5817 | 7299 | 5817 | 7299 |
| $R^2$ | 0.092 | 0.073 | 0.060 | 0.070 |

*Note*: The dependent variable of columns 1 and 2 is a dummy variable indicating whether the firm reports using a high degree of external digital tools (i.e., for an above average number of business functions), and the dependent variable of columns 3 and 4 is a dummy variable indicating whether the firm reports using internal digital tools. Columns 1 and 3 include the subsample of firms in countries with above sample median measure of inequality defined by the panel and columns 2 and 4 include the subsample of firms in countries with equal to or below sample median gender inequality. Panel A splits the sample based on a composite measure of gender inequality (World Economic Forum, 2016). Panel B splits the sample based on the share of female post-secondary graduates that majored in ICT (OECD, 2016). Note that data from Panel B is only available for OECD countries. All specifications include the firm-level controls included in Table 2, industry, country, and year fixed effects. Standard errors clustered at the country level.

## Table 5: Digital gender gap in tool use and non-work related demands

| DV: | External digital tool | | | Internal digital tool | | |
|---|---|---|---|---|---|---|
| Sample: | Full | High female participation | Low female participation | Full | High female participation | Low female participation |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Female firm | -0.002 | 0.005 | -0.013 | -0.021 | -0.024 | -0.017 |
| | (0.007) | (0.011) | (0.009) | (0.006) | (0.010) | (0.007) |
| Founded for WLB | 0.013 | 0.061 | -0.038 | 0.029 | 0.081 | -0.026 |
| | (0.024) | (0.035) | (0.028) | (0.023) | (0.032) | (0.027) |
| Female firm x Founded for WLB | 0.069 | 0.007 | 0.137 | 0.010 | -0.032 | 0.051 |
| | (0.036) | (0.051) | (0.040) | (0.023) | (0.029) | (0.033) |
| Observations | 23,033 | 12,904 | 10,129 | 23,033 | 12,904 | 10,129 |
| $R^2$ | 0.097 | 0.081 | 0.120 | 0.080 | 0.082 | 0.080 |

*Note*: OLS regressions. The dependent variable of columns 1 to 3 is a dummy variable indicating whether the firm reports using a high degree of external digital tools (i.e., for an above average number of business functions), and the dependent variable of columns 4 to 6 is a dummy variable indicating whether the firm reports using internal digital tools. Columns 2 and 5 are sub-samples of firms located in countries with high female labor force participation (World Bank, 2015), and columns 3 and 6 are sub-samples of firms located in countries with low female labor force participation. All specifications include firm-level controls from Table 2, industry, country, and year fixed effects. Standard errors clustered at the country level.

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## Appendix A Additional Tables

**Table A1: Example of how entrepreneurs with different levels of non-work activities manage work demands**

| | Entrepreneur a: Household time demands=1<br>Total available time=10<br>Work time$^{Min}$ = 5 | Entrepreneur b: Household time demands=7<br>Total available time=10<br>Work time$^{Min}$ = 5 |
|---|---|---|
| Time allocation | Household time = 1<br>5≤Work time≤9<br>Leisure time ≤ 4 (10 - 1 - Work time) | Household time = 7<br>Work time = 3 <Work time$^{Min}$<br>Leisure time = 0 (10 - 7 - Work time) |

Note: This table presents a scenario of how two entrepreneurs that differ in their non-work related activities manage their work demands. Entrepreneur $a$ and $b$ both have a total of 10 hours a day to spend on work and non-work activities. They both need to spend at least 5 hours a day at work to keep their business afloat. Entrepreneur $a$ and needs to spend 1 hour of their total time on household responsibilities (e.g., childcare, cleaning, etc.), whereas entrepreneur $b$ needs to send 7 hours of their time on household responsibilities. We assume entrepreneurs never spend more time than required on household responsibilities, but that these responsibilities are binding (e.g., children cannot be left unfed) and take priority over work and leisure. Entrepreneurs need to meet minimum work-time requirements to keep their businesses afloat and may spend remaining time on additional work activities or leisure. In this scenario, work-time demands are sufficiently high that, while entrepreneur $a$ can still meet their work-related demands in order to keep their business afloat, entrepreneur $b$ does not have sufficient time to meet the minimum work-time demand to keep their business afloat due to their higher level of household demands. Thus, entrepreneur $b$ cannot persist in entrepreneurship, unless they can meet their work requirements in less time. Note that entrepreneurs $a$ and $b$ may have similar preferences to spend time on leisure activities but differ on non-work *demands*, which take priority over other leisure activities. Our findings suggest that the expected benefits of using digital tools is higher for entrepreneur $b$, as they allow $b$ to meet minimum work requirements and keep their business afloat. Note that adoption costs may differentially impact the *net* benefits received by entrepreneurs $a$ and $b$ from using digital tools.

**Table A2: Represented Industries by Gender**

| | Male Owned | Female Owned | p-value, Difference |
|---|---|---|---|
| Manufacturing | 0.039 | 0.031 | 0.001** |
| | (0.002) | (0.002) | |
| Construction or home repair | 0.050 | 0.024 | 0.000*** |
| | (0.002) | (0.002) | |
| Retail or wholesale (inc. online shops) | 0.169 | 0.200 | 0.000*** |
| | (0.003) | (0.004) | |
| Automotive repair or services | 0.028 | 0.013 | 0.000*** |
| | (0.001) | (0.001) | |
| Accommodation (e.g., hotels, camping grounds) | 0.029 | 0.029 | 0.661 |
| | (0.001) | (0.002) | |
| Restaurant/café or other food services | 0.084 | 0.083 | 0.901 |
| | (0.278) | (0.237) | |
| Media, communication or information | 0.100 | 0.051 | 0.000*** |
| (e.g., broadcasting, telecoms, computer programming) | (0.003) | (0.002) | |
| Professional services (e.g., financial services, | 0.121 | 0.099 | 0.000*** |
| consulting, travel agents, business services) | (0.003) | (0.003) | |
| Real estate | 0.030 | 0.024 | 0.004** |
| (e.g., brokerage, leasing, management) | (0.002) | (0.002) | |
| Education | 0.029 | 0.027 | 0.361 |
| (e.g., schools, tutoring, driving school) | (0.001) | (0.002) | |
| Healthcare | 0.029 | 0.051 | 0.000*** |
| (e.g., dentist, senior care) | (0.001) | (0.002) | |
| Personal services | 0.068 | 0.160 | 0.000*** |
| (e.g. beauty and wellness, repair of household goods) | (0.002) | (0.004) | |
| Arts, entertainment or recreation | 0.064 | 0.067 | 0.317 |
| (e.g., museum, creative arts, sports club) | (0.002) | (0.002) | |
| Transportation or storage | 0.016 | 0.008 | 0.000*** |
| (e.g., taxi, warehousing) | (0.001) | (0.001) | |
| Non-profit/charity organization | 0.011 | 0.009 | 0.1771 |
| | (0.200) | (0.181) | |
| Other | 0.132 | 0.125 | 0.082* |
| | (0.003) | (0.003) | |
| N | 12,925 | 10,108 | |

*Note*: This table presents the share of female and male-founded firms in each industry.

## Table A3: Digital gender gap, by internet usage

| | (1) | (2) |
|---|---|---|
| | Internal digital tool | |
| | High internet use | Low internet use |
| Female Firm | -0.016 | -0.028 |
| | (0.008) | (0.008) |
| Observations | 10620 | 11058 |
| $R^2$ | 0.077 | 0.082 |

*Note*: The dependent variable is a dummy variable indicating whether the firm reports using internal digital tools. Column 1 includes the subsample of countries in which an above sample median percent of people use the internet, and column 2 includes the subsample of countries in which a below sample median percent of people use the internet. Data on internet usage comes from the World Bank. All specifications include the firm-level controls included in Table 2, industry, country, and year fixed effects. Standard errors clustered at the country level.

## Table A4: Internal digital tool gender gap, by number of employees

| | (1) | (2) |
|---|---|---|
| | Internal Tool Adoption | |
| | At least one employee | No employees |
| Female Firm | -0.024 | -0.015 |
| | (0.008) | (0.007) |
| Observations | 13868 | 10082 |
| $R^2$ | 0.063 | 0.066 |

*Note*: The dependent variable in both columns is a dummy variable indicating whether the firm reports using internal digital tools. Column 1 includes the subsample of firms with at least one employee and column 2 includes the subsample of firms with no employees (founder-only). All specifications include firm-level controls for VC investment and challenges faced as well as industry, country, and year fixed effects. Standard errors clustered at the country level.

**Table A5: Robustness of relationship between female firm and internal digital tools to omitted variable bias**

| | (1) Baseline Effect (Std. Error) $[R^2]$ | (2) Controlled Effect (Std. Error) $[R^2]$ | (3) % Change in Coefficient | (4) % Change in $R^2$ | (5) Bias Adjusted $\beta$ $R_{max} = 1.3\tilde{R}$, $\delta = 1$ | (6) $\delta$ for $\beta$=0 |
|---|---|---|---|---|---|---|
| Female Firm | -0.026 (0.007)[0.035] | -0.021 (0.006)[0.085] | 19% | 143% | -0.017 | 4.646 |

*Note*: The intuition of testing for omitted variables is that in cases where observed controls share covariance with the unobservable controls, the quality of the controls will be diagnosed by the stability of the coefficient and by the movement in R-squared when the observable controls are included. This table shows the coefficient of controlled and uncontrolled regressions with percent change in coefficient and R-squared. The baseline model includes industry, country, and year fixed effects. Column 1 shows the estimated coefficient for the baseline model (together with standard errors in parentheses and the R-squared in brackets). Column 2 presents the point estimate for the model with all control variables and fixed effects. These findings point to a relative small movement in coefficients along with a large movement in the R-squared values (columns 3 and 4). To test the robustness of the female coefficient to omitted variables, we perform two tests: 1) develop a conservative upper bound for $R_{max}$ and report the value of a bias-adjusted $\beta$ which is produced by $\delta = 1$, and 2) report the value of $\delta$ for which the estimator would produce a treatment effect of zero. In the former case, showing that the adjusted $\beta$ leads to the same conclusion would be a natural standard; in the latter, a value of $\delta > 1$ would be seen as suggesting a robust result. In column 5 we use the bounding value suggested by Oster (2019) to calculate the bias-adjusted $\beta$ with the assumption that the coefficient of proportionality $\delta = 1$ and , $R_{max} = 1.3\tilde{R}$. Denoting the fully controlled R-squared as $\tilde{R}$, $R_{max} = 1.3\tilde{R}$ captures the idea that there is variation in how predictable outcomes are, and this variation can be roughly inferred from how much is predicted by the observables. Column 5 shows that the bias-adjusted $\beta$ is similar to the estimated $\beta$ with observed controls in column 2. In column 6, we calculate the proportional selection coefficient, $\delta$, for which the relationship between digital tools and the *Female firm* is zero. This can be interpreted as the degree of selection on unobservables relative to observables which would be necessary to explain away the result. This shows that unobservables would have to be four and a half times as important as observables for the effect to be zero. See Oster (2019) for more details.