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

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Abstract

The adoption of digital technology is an important strategic decision for entrepreneurial firms. In addition to enhancing the firm's productivity, digital technologies may also benefit founders by providing them with enhanced capacity to engage with simultaneous demands on their attention. We argue that this additional capacity is especially consequential for female founders who have greater non-work related demands and, hence, have more limited time for their business. However, female founders may also face higher barriers to technology adoption, which makes it unclear to what extent they use technology in their businesses. Using a cross-section of 23,033 small businesses across 42 countries, we show that there is a digital gender gap among entrepreneurs 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., financial management). This pattern is present across the world, including in countries that are considered relatively gender equal. We do not find evidence that this gap is due to gender differences in founding industry or firm characteristics, but that it is correlated with digital skills. However, female founders who have greater non-work related demands (proxied by work-life balance founding motivation) are more likely to adopt digital tools, including ones for which they likely face higher adoption costs. Our findings highlight the role of digital technology in alleviating time constraints for female entrepreneurs beyond conferring firm-specific benefits.

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

JEL Codes: J16, J22, L26

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1 Introduction

Digital technologies have significantly reduced the cost of performing various business functions (e.g., Agrawal et al., 2014; Belleflamme et al., 2015; Goldfarb and Tucker, 2019; Greenstein, 2020). For instance, by aggregating demand from across the world, digital technologies, like Google Ads and Shopify, allow firms to advertise and sell to a larger pool of customers than they could feasibly access in the absence of these technologies; digital tools like Quickbooks and Sortly allow firms to reduce the time and labor requirements of filing taxes and managing inventories manually. While there has been much attention on the firm productivity benefits of adopting digital technology in the context of large enterprises (e.g., Autor, 2001; Athey and Stern, 2002; Baker and Hubbard, 2004; Draca et al., 2007; Brynjolfsson and Saunders, 2010; Kuhn and Mansour, 2014; Bronsoler et al., 2021), there is little evidence on the extent to which digital technology is used among small firms (Bates et al., 2018; Bar-Gill et al., 2023) and the types of benefits it confers.

In this paper, we argue that the adoption of digital technology in small businesses is a consequential strategic decision because in addition to the productivity benefits that accrue to the firm, digital technology may also directly benefit founders. Relative to performing a business function manually, adopting a digital tool to perform a task provides founders with enhanced capacity to engage with other activities that simultaneously demand their attention. For instance, adopting an inventory management technology allows founders to spend less time on tracking inventory, freeing up the founder to spend time on product development and customer engagement. This additional capacity is particularly beneficial during the startup stage when there are acute constraints on attention, labor, and capital (Gifford, 1992; Hyytinen et al., 2006; Yoo et al., 2016; Gans et al., 2025).

We expect this founder-benefit of digital technology to be especially consequential for female founders with high levels of non-work related demands, such as childcare and household responsibilities, that further constrain the time they can devote to their business. Prior work has shown that women continue to bear higher shares of non-work related tasks (Gurley-Calvez et al., 2009; Alon et al., 2020; Delecourt and Fitzpatrick, 2021; Kepler et al., 2007; Cowan et al., 2023), and as such, self-employed women with children spend less time on work and more time on childcare compared to their self-employed male counterparts and salaried and wage employed women Gurley-Calvez et al. (2009). Given the myriad of work demands during the initial stages of the startup, female founders' more limited work time may negatively impact firm survival and performance. These patterns suggest that there are potentially higher returns to adopting digital tools for female entrepreneurs that face non-work related demands, as they can increase the relative efficiency of their more limited work time.

However, female entrepreneurs may also face higher costs of digital technology adoption. While there is limited evidence on whether female entrepreneurs use technology at a lower rate than their male counterparts (Aruleba et al., 2023; Chen et al., 2023), women, on average, tend to use the internet and mobile devices at lower rates than men, likely due barriers to access (International Telecommunication Union, 2022; UNESCO, 2019), such as the price of technology acquisition, cultural norms, and digital skills. Thus, despite the potential benefits, it is unclear ex ante whether *and* when female entrepreneurs are differentially likely to adopt digital technology, and if differences in technology use are uniform across technology types.

In this paper, we examine whether there are gender disparities in the use of digital technology among small business owners across the world and investigate the extent to which technology adoption relates to a founder's non-work demands. We make progress on this question 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 Facebook survey data from a cross-section of 23,033 small businesses 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—to the same extent; however, women are significantly less likely to use internal digital tools—those used to manage internal business activities, such as financial management and quality control. In particular, the digital gender gap for internal digital tools is present across the majority of countries in our sample, including those that are considered relatively gender equal on key socioeconomic dimensions. To our knowledge, our study is the first to quantify the digital gender gap in terms of technology use among a large sample of small businesses across the world.

Second, we 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 primarily due to differences in internet access. We also do not find evidence that differences in founding industry or firm characteristics explain the differential internal digital tool use between male and female entrepreneurs. Taking advantage of the richness of our cross section, we find evidence consistent with the interpretation that gender disparities in information, communication, and technology (ICT) knowledge is correlated with the gender gap in internal digital tool use.

Third, we investigate whether the founder-specific benefit of digital tools—their time saving nature—

differentially relates to their use between male and female entrepreneurs. 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 are more likely to use both types of digital tools. In particular, they 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 particularly pronounced for female founders who start businesses in countries where institutional support for childcare and work-life conflicts is relatively low, and hence face even greater non-work related challenges that constrain their work time (OECD, 2018; Thébaud, 2015). 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 among entrepreneurs with online presence is primarily concentrated in the use of internal digital tools, and this gap exists across almost all countries in our sample, including those that are considered relatively gender equal. We find evidence that suggests this digital gender gap is related to differences in ICT knowledge. The lack of a gender gap for the use of external digital tools may be because they tend to be easier to use, more readily accessible, and their use may be driven by industry norms. We also highlight a founder-specific benefit of digital tools, which reduces (and in some cases, reverses) the digital gender gap in the entrepreneurial setting: founder time management. In particular, we find that female founders who face non-work-related demands are more likely to adopt digital technology, including internal digital tools that likely require greater digital knowledge to use. This is consistent with interpretation that female entrepreneurs who face binding non-work constraints and hence have less time for their business are more willing to incur technology adoption costs.

Our study provides three main contributions. It is among the first, to our knowledge, to connect the literature on gender inequality in entrepreneurship to the research on digitization. While prior work has shown a variety of demand-side and supply-side factors that contribute to gender disparities in entrepreneurial participation and outcomes, such as differences in exposure, networks, and institutional practices (e.g. Ding et al., 2006; Guzman and Kacperczyk, 2019; Howell and Nanda, 2019; Bell et al., 2019; Zandberg, 2021; Marx, 2021), our study highlights another dimension of gender inequality in entrepreneurship—the (lack of) use of internal digital technology. In addition, our results go a step further in highlighting a condition under which this technology usage gap is reduced—when female founders face non-work related 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. Given that an

increasing share of female founders cite work-life-balance as a reason to pursue entrepreneurship (Heilman and Chen, 2003; Thébaud, 2015; Yang et al., 2023) but spend less time on their ventures than their male counterparts (Gurley-Calvez et al., 2009), our findings provide implications for the conditions under which technology may reduce or exacerbate gender inequality in entrepreneurship.

Second, our study adds to the literature on the use of digital technology. While prior work has primarily examined the adoption consequences of digital tools in the context of large enterprises and regions (Bar-Gill et al., 2023), we are among the first, to our knowledge, to document the use of digital technology in small businesses and entrepreneurial settings.[1] In particular, we highlight that the benefit of digital tools extends beyond conferring productivity benefits to the firm (e.g., Athey and Stern, 2002; Goldfarb and Tucker, 2019; Greenstein, 2020) but also offers a founder-specific benefit, which is a function of a founder's non-work related demands.

Third, we add more precision to the policy discussion on the digital gender gap in two ways. Foremost, we contribute to the limited studies that have examined gender disparities in the *use* of digital technologies (Chen et al., 2023; Aruleba et al., 2023).[2] While commentators typically refer to the digital gender gap in terms of access to the internet, our findings show that even in contexts where internet access is available to both male and female populations, there is a gender gap in the usage of certain types of digital technologies that persists across countries with varying levels of gender equality. Thus, reducing the cost of accessing internet and mobile devices alone is likely a necessary but insufficient condition for eliminating the digital gender gap. In addition, our finding that the digital gender gap among entrepreneurs is primarily concentrated in internal digital tools highlights the importance of disaggregating the digital gender gap by technology types. Given these types of tools support internal resource allocation decisions, which become increasingly complex as the firm expands (e.g. Greiner, 1998; Robinson Jr and Pearce II, 1986), interventions directed toward facilitating the use of these types of tools may not only affect the survival but also the growth potential of female firms by improving internal resource allocation and efficiency. Moreover, given we find this gap is prevalent across all countries in our sample, interventions that aim to reduce disparities in digital skills may be valuable even in countries that are considered "gender equal" by conventional metrics.

The paper is organized as follows. Section 2 discusses the founder-specific costs and benefits of adopting

[1] While prior work has shown how lowered search costs has increased performance of niche products (e.g., Brynjolfsson, 2011; Zhang, 2018; Aguiar and Waldfogel, 2018), a recent review piece by Bates et al. (2018) point to the limited work on how digitization affects traditionally disadvantaged subgroups, such as women and minorities, in entrepreneurship.

[2] Chen et al. (2023) is one of the few studies that documents a gender gap in the usage of fintech products and services across 28 countries. 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 date, there is a dearth of systematic data that measures the usage of different types of digital technology by men and women, particularly among entrepreneurs.

digital technology, and how it may differentially relate to the gender of the founder. Section 3 describes the data and our empirical approach. Section 4 presents the results on the digital gender gap in our setting and how non-work related demands affect the likelihood of technology use. Section 5 concludes.

2 Founder Decision to Adopt Digital Technology and Founder Gender

Whether an entrepreneur decides to adopt a digital technology in their business is a consequential strategic decision. In this section, we aim to clarify the types of benefits and costs that may arise in technology adoption, and how they may vary by gender. These arguments help us to understand whether we should expect a digital gender gap ex ante, and how non-work related demands may shape the *net* benefits from digital tool adoption.

2.1 Benefits of digital technology adoption for the startup and the founder

Prior work has focused on the benefits that are conferred to the firm by adopting digital technology. Digitization has reduced search, transaction, and verification costs, (Goldfarb and Tucker, 2019; Greenstein, 2020), and has been shown to improve the productivity of various business functions. For instance, digital technologies facilitate identification and communication with employees and customers (Autor, 2001; Kuhn and Mansour, 2014), advertising and sales (Bakos, 2001; Dana and Orlov, 2014), and have 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; Bloom and Reenen., 2012) by reducing operating expenses and labor requirements (Agrawal and Goldfarb, 2008; Dranove et al., 2014; Bronsoler et al., 2021).[3] That is, technology allows firms to increase output for a given set of inputs or resources (Syverson, 2011). 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).

A related consequence of digitization is that it has changed 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 a greater variety of products to find a market, including those that received little demand offline (e.g., Brynjolfsson, 2011; Zhang, 2018; Aguiar and Waldfogel, 2018). While product composition

[3]See for example, (Athey and Stern, 2002), who find the adoption of enhanced 911 is correlated with improved health outcomes of the patient upon ambulance arrival, lower rates of mortality and hospital costs.

changes caused by digitization have been almost exclusively documented in the context of creative industries, we might expect digital technology to disproportionately reduce the challenges of operating a business for female founders in a number of ways. For instance, given that women are less likely to receive equity investments or bank loans, often due to discrimination during the evaluation process (Ewens and Townsend, 2019; Hebert, 2020; de Andrés et al., 2021), crowdfunding platforms may help expand the number and diversity of potential investors and provide potentially better matches through improved information (Agrawal et al., 2014). Similarly, given 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, digital technology may help female founders 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 the financial and social capital needed to sustain a startup.

Apart from the firm-specific benefits of technology adoption for small businesses discussed above, a key argument we make in this paper is that technology also confers individual time-saving benefits to the founder of a small business. During the startup stage, founders are faced with simultaneous demands on their time, from identifying customers and suppliers to managing operations and finances. In the absence of adopting a digital technology, founders would have to perform the business function manually, either by themselves, hiring an employee, or outsourcing the function to another firm. However, founders may not have the option to delegate tasks to hired workers or contractors during the startup stage when there are acute constraints on attention, labor, and capital (Gifford, 1992; Hyytinen et al., 2006; Yoo et al., 2016; Gans et al., 2025), and for activities in which the founder plays a critical role in the decision-making process. Thus, relative to a manual approach, substituting a digital technology to perform a business activity provides the founder with additional capacity to engage in other activities.[4]

We expect this founder-specific benefit of technology adoption to be even more consequential for founders who have non-work responsibilities (e.g., childcare) that further constrain the time they have for their business. Prior work shows 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;

[4]The firm-benefit from adopting technology has typically been modeled as augmenting human labor (usually the employee) (Brynjolfsson and McAfee, 2012; Bessen, 2016). The implication from this line of research (and, notably, the current work on AI and worker displacement) is that the technology reduces the required labor-time for a given output and as a result, firms reduce their labor force or redeploy workers to less-automatable tasks (Agrawal et al., 2023; Bessen et al., 2023b,a). In our conceptualization of the founder-benefit, digital technology can both augment the founder's labor, which boosts the start-up's productivity (e.g., through improved customer search), as well as substitute for the founder's labor (e.g., less founder time is needed for marketing), which provides the founder with additional capacity. Since the founder has a choice on how to allocate their time, they may choose to allocate their additional capacity to achieve better outcomes on one business activity (e.g., network with key clients), work on a broader set of activities (e.g., engage in product development), or meet non-work responsibilities.

Cowan et al., 2023). Thus, even if the relative firm-specific benefit from adopting digital tools is the same for male and female entrepreneurs (i.e., male and female firms receive the same boost in sales from adopting Google Ads compared to marketing by word-of-mouth), female founders who have higher non-work-related demands may benefit more from the time saving nature of digital tools as they allow them to maintain their work productivity while meeting their non-work responsibilities.

Consider a simple example illustrated in Table A1 where two entrepreneurs, a and b, have varying levels of non-work related demands. Without digital technology, entrepreneur b, who has higher levels of non-work demands, cannot meet the minimum work time required to keep her business afloat—i.e., she does not have enough capacity to perform the necessary tasks to keep her firm operational. However, digital tool use reduces the minimum work time required for business survival (e.g., automated inventory management versus manual tracking) such that entrepreneur b is able meet her work demands despite her higher levels of non-work responsibilities. Adopting the technology does not impact the firm survival of entrepreneur a, who has lower levels of non-work related demands, but the additional capacity allows them to spend more time on other business tasks or leisure.

The above arguments suggest that there are potentially greater returns to adopting digital technology for female entrepreneurs, particularly for those who face higher levels of non-work related responsibilities.

2.2 Costs of digital technology adoption

Adopting a technology requires incurring costs. This may include the direct costs of purchasing and setting up the technology, similar to purchasing a piece of equipment; it may also include indirect costs, such as learning to use the technology and integrating it with the business. Prior work suggests that small firms including new ventures tend to be less technologically sophisticated than large firms and a large fraction of firms continue to perform key business functions, such as inventory management and information storage, manually (Zolas et al., 2021; Cirera et al., 2022). One reason is that adopting digital tools requires financial resources and time to integrate them into the business (Bessen, 2002). For example, effective adoption of new technologies can require significant complementary investments such that the cost of adoption can far exceed the direct costs of the technology itself (Brynjolfsson and Hitt, 2003). Given the resource constraints new ventures face, these costs may be prohibitive even if the benefits from adoption are large.

While there is limited systematic evidence that female entrepreneurs face higher costs of technology adoption than their male counterparts, suggestive evidence is consistent with this being true on average. First, policy reports argue that women face disproportionate barriers in accessing the internet and mobile

devices, and, as a result, may be less likely to use digital technology (OECD, 2018; UNICEF, 2022). Policy reports also suggest that cultural norms and technology literacy may contribute to women's lower rate 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, which impact their ability to utilize digital tools. While these barriers have been shown in the broader population, we expect that they are mirrored in the entrepreneurial population. Second, female founders likely have fewer financial resources to make capital investments (e.g. Coleman, 2009; Ewens and Townsend, 2019; Hebert, 2020), making the acquisition cost of technology relatively more expensive. Thus, we expect female-led ventures to face higher costs of adopting technology on average.

The arguments in Section 2.1 and 2.2 suggest that it is not obvious whether there is a digital gender gap in technology use, as female entrepreneurs may face both higher returns and costs to adopting digital tools in their business. Thus, whether a female entrepreneur adopts a digital tool is a function of whether the benefits it confers outweighs its adoption cost, where the benefit is a function of both the returns to the firm and to the founder's capacity to manage time demands. This relationship is further complicated by the fact that the benefits and costs of various digital tools are inherently not uniform, which suggests that the magnitude of the digital gender gap is likely to vary across tool types.

This latter point is worth underscoring for two related reasons. First, for the most part, policy discussions around the digital gender gap tends to refer to ICT, which encompasses a broad set of technologies. However, given that digital tools may vary widely in price (e.g., some like social media have no direct cost of use) and function, it is helpful to understand where the gender disparities in use occurs. Second, while there is a notion that technology has the potential to democratize the labor market for disadvantaged subgroups (e.g., Agrawal et al., 2016, 2023), the necessary condition for this to be realized is that these groups use the technology. Thus, to the extent that certain technologies are systematically not adopted by disadvantaged subgroups such as women due to higher adoption costs, that may exacerbate existing inequalities. On the other hand, if certain technologies are optimally not adopted because they confer lower benefits for their businesses (e.g., if women tend to start firms where technology does not significantly change their productivity) then the policy implication is to understand whether there are other market frictions (e.g., differences in entry barriers) that can be alleviated to induce more equitable participation and outcomes.

While we are not able to separately measure the costs and benefits from adopting digital tools, we use patterns of digital tool use to infer how the *net* benefits may vary across founders by gender and then consider

whether these differences in use may be attributed to differences in costs or benefits. We also consider the use of two distinct types of digital tools, which differ in a variety of dimensions, including access, which help us examine what might be driving any observed gender gap.

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 across 42 countries. This means all respondents have access to the internet and some knowledge of digital technologies. Thus, we are able to rule out the most commonly discussed contributor of the digital gender gap—lack of internet access. All survey respondents in our sample are firm owners and 85% are founders.[6]

A range of industries are represented in our data, as summarized by entrepreneur gender representation in Table A2. The industries with the largest representation in our sample are retail or wholesale (16%), restaurant/cafe or other food services (9%), and professional services (e.g. financial services, consulting) (8%).

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.

While our sample is representative of Facebook page business owners in each country, one concern is that it may not be representative of each country's business population in general.[8] Given the low cost of creating

[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.

[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.

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 representative of active businesses in these countries. However, 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]

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, inventory management tools like Sortly, and accounting tools like QuickBooks.

Given that firms in our sample all have Facebook business pages, which are 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

[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).

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

four business activities.[13] Thus, *External digital tool use* captures the relative intensity of external digital tool use in small businesses.

Internal digital tool use is a binary variable that is equal to one if the firm uses internal digital tools, and zero otherwise. Thus, it captures the extensive margin of internal digital tool use.[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. The lower rate of internal tool relative to external tool use across the entire sample suggests that there are lower net benefits to adopting internal digital tools for small businesses. This might reflect the lower perceived benefits of these tools or because they are costlier to adopt compared to external digital tools.

3.1.2 Independent variables

We define a firm as a *Female firm* if more than half of owners/founders are female. Our results are unchanged if we define it as 100% female owned. About 44% of firms in our sample are female owned. Over 92% of firms in our sample are managed/owned by 4 or less people, including 53% of the firms that have just one manager/owner.

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 related 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. We expect WLB motivations to be more reflective of non-work responsibilities (e.g., childcare) rather than simply preference for leisure activities for two reasons. First, the survey also includes founding motivations "to pursue an interest/hobby" and "to be more creative" which is more likely to capture a founder's preference to engage in leisure activities. Second, 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 (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.

[13] In Table A4 we show our results are similar if we use indicators for whether the firm uses a digital tool for each external-facing business function 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 digital tools for distinct internal business activities.

The richness of our cross-country variation allows us to examine potential contributors to the digital gender gap. To proxy for gender disparity in digital skills, we use data from the OECD[15] 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.[16] Because this data is from the OECD, it is available for 22 (or 57%) 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 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). In other words, we expect female entrepreneurs who start their firm primarily to manage WLB in countries with lower female labor force participation to face even greater barriers in meeting their non-work related demands, and thus, have greater founder-specific returns to using digital tools in their business, all else equal. We measure female labor force participation using data from the World Bank.[17]

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 employees (founder only), 49% have between 2 and 9 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

[15] Source: https://stats.oecd.org/index.aspx?queryid=108601
[16] https://stats.oecd.org/index.aspx?queryid=108601.
[17] Data source: https://data.worldbank.org/indicator/SL.TLF.ACTI.FE.ZS

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 one if firm i is female owned, and zero otherwise. Thus, β_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 relatively high tendency to use 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.

Because our research question is to investigate whether there is a digital gender gap and whether it is due to differential underlying costs and benefits of adoption (that is, we are interested in the endogenous selection of digital tools), the main alternative explanation 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, β_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 across the world. Figure 1's Panel A and B plot the average tool use by male and female entrepreneurs in the 42 countries in our sample 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. Moreover, Figure A1, which splits firms by whether their founding country is above the median gender equality score assigned by the World Economic Forum, shows that the gender gap in internal digital tool usage persists even in countries that are considered relatively more gender equal along key socioeconomic dimensions.[18]

Table 2 confirms these patterns in regression analyses. Columns 1 and 4 examine female entrepreneurs' likelihood of using a high degree of external digital tools and whether they use internal digital tools, respectively. 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 characteristics (e.g., firm size, receipt of VC funding, and the number of business challenges they report facing), and industry and country fixed effects.

[18]The World Economic Forum assigns a gender equality score to a country based on women's economic participation and opportunity, educational attainment, health and survival, and political empowerment.

Columns 2 and 3 and columns 5 and 6 capture firms in countries that are considered to have relatively higher and lower gender equality, respectively. They show that the internal digital tool gender gap is significant in both relatively gender equal and less equal countries.

4.2 Digital gender gap for internal digital tools: possible explanations

The above findings are consistent with the interpretation that male and female entrepreneurs in our sample face similar *net* benefits of external digital tools use. This may be because these tools are relatively easy to adopt, many are free and easily accessible (e.g., social media), 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).[19] Nevertheless, it is noteworthy that male and female founders are not only similar in their *likelihood* of adopting external digital tools (which is less surprising given every firm in our sample has a Facebook page), but also similar in their *intensity* of external digital tools use, and this similarity holds in both relatively gender equal and unequal countries.[20]

In contrast, the net benefits from internal digital tool use may be lower for female entrepreneurs than for male entrepreneurs because they face lower benefits to using these types of tools (for instance, due to the types of businesses they found), or because they face higher adoption costs. While we are not able to pinpoint the causal reasons that lead to a lower rate of internal digital tool use by female entrepreneurs, we explore possible (and not-mutually exclusive) explanations below.

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.[21] We investigate this interpretation by splitting the sample by industries in which digital tools are more and less likely to be used in Table A5. If female founders 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 as their male counterparts in sectors that require internal tools to conduct business, such as accommodation (e.g.,

[19] 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.

[20] As discussed in Section 3.1, the dependent variable *External digital tool* captures the intensive margin in use. Table A4 confirms these patterns even if we break down the each external business function, such as using a digital tool to show product/services, communicate or advertise to customers.

[21] 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).

hotels) and professional services (e.g., financial services). Table A5 demonstrate that in both high and low internal tool requirement industries, female entrepreneurs are equally *less* likely (p-value < 0.05) to adopt internal digital 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 within industries. For instance, if female firms are less likely to be growth oriented (Coleman, 2009; Guzman and Kacperczyk, 2019), 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. We provide two pieces of evidence that suggest, for the most part, differences in firm characteristics between male and female firms are not driving the internal digital tool gender gap.

First, we take advantage of a survey question that asks whether the firm uses "an accountant, lawyer or other external consultant to help with your tax and regulatory obligations" to capture the professionalization of the firm. In Table A6, we split the sample by firms that use an accountant (61 % of the sample) and show that the gender gap for internal tool use among firms that use an accountant is roughly the same magnitude as the estimate in Table 2. We find that the gender gap among the set of firms that do not use an accountant is larger in magnitude, suggesting that less professionalized female firms may be even less likely to adopt internal digital tools.

Second, given that VC funding correlates with firm quality and growth potential, we split the sample by firms that receive VC funding (3.9% of our sample) in Table A7. We show that the internal tool digital gender gap is primarily driven by firms that do not receive VC funding. That is, among the small fraction of firms that receive VC funding, we do not observe a significant difference in internal digital tool usage, although the sign is negative.[22]

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 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 is diagnosed by the stability of the coefficient and by the movement in R-squared when the observable controls are included. In Table A8, we find that the bias-

[22]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.

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.[23]

Taken together, the results above suggest that the lower rate of internal digital tool use by female entrepreneurs is likely not primarily due to the lower benefits of adopting these types of tools as a result of differences in industry and firm characteristics. The internal digital tool gender gap is present among firms that are more professionalized. Only in the very small subset of firms that receive VC funding do we not find gender differences in internal digital tool usage. Our findings thus far also confirm that the lack of a gender gap for external digital tools holds regardless of differences in industry and firm characteristics.

Next, we examine whether the lower rate of internal tool use by female entrepreneurs is because they face a higher cost of adoption, which may stem from unequal access and acquisition costs. While the predominant explanation for lower rates of female participation in the digital economy is their relative lack of internet access (OECD, 2018), an attractive feature of our sample, as discussed above, is that it consists of entrepreneurs that have Facebook pages, making it unlikely that lack of internal digital tool use is primarily explained by higher adoption costs due to gender differences in internet access.

Price. One possibility for the lower rate of internal digital tool use is that they tend to be relatively more expensive to acquire (e.g., Turbo Tax) compared to external digital tools, for which many are free to use (e.g., social media). If female firms are more capital constrained, then they may be less willing to incur capital expenditures to purchase internal digital tools. While we lack detailed price data for digital tools, our analyses in Table A6, to some extent, help address this concern, as we expect more professionalized firms to be more financially able to adopt internal digital tools. In addition, to the extent that this lower tendency to make capital investments is more pronounced when firms are young, Table A9 splits the sample by firm age and shows that the magnitude of the internal digital tool gender gap is virtually unchanged for firms that are young (3 years or younger) or old (older than 3 years).

Digital skills. Finally, we consider whether female entrepreneurs may face higher adoption costs that stem from informational barriers that prevent them from understanding how to use internal digital tools in their business. In contrast to external digital tools, which are primarily used to perform business activities like marketing and sales, internal digital tools may be used to manage a range of business activities that pertain to the internal management of the firm, such as human resources, quality control, and financial management. Prior work shows that these firm activities are complex management practices that have

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

varied adoption across firms, largely due to information barriers (Bloom et al., 2013; Bloom and Reenen., 2019; Bloom and Van Reenen, 2010). If female entrepreneurs are 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, we might see lower internal digital tool adoption in their firms. While a wide range of factors may contribute to information barriers, policy reports suggest that the lack of digital skills may be a key barrier in female participation in the digital economy (OECD, 2018; UNICEF, 2023).

In Table A10, we explore this potential source of information barrier 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. 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). By contrast, the gender gap for external digital tools remains statistically insignificant regardless of the share of female graduates in ICT, suggesting that improvements in digital skills does not affect the intensity of external digital tool use by female founders.

Taken together, our findings in this section suggest that female entrepreneurs' lower rate of internal digital tool use is driven by a higher cost of adopting these types of digital tools relative to male entrepreneurs and that this higher cost may be, at least in part, due to a disparity in digital skills. This finding is noteworthy given our sample consists of founders that have an online presence and presumably have higher levels of digital literacy compared to the broader population. Furthermore, 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, such as through the development of digital skills, may help improve survival and firm performance of female-led firms.

4.3 Digital gender gap 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 digital skills. 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 earlier, we highlight that in an entrepreneurial setting, digital technology not only confers firm-specific benefits but also alleviates time constraints of the founder, which may be particularly acute for female founders who have additional non-work related demands that further limit 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 3 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 3 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 3 split the sample by entrepreneurs who start their firm in high and low female labor force participation countries, respectively, to capture settings that provide high and low institutional support for managing work-life conflicts (e.g., paid leave), which further affects entrepreneurs' non-work related demands. 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, and hence arguably face greater barriers in managing their non-work related demands alongside their business. In fact, 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.[24] Moreover, the triple interaction in column 4 shows that women who start firms for WLB in low female participation countries are significantly more likely to adopt external digital tools compared to their counterparts in high female participation countries that arguably have more institutional support to manage

[24]The p-value in column 3 of $FemaleFirm+FemaleFirmxWLB = 0$ is 0.008; the p-value of $WLB+FemaleFirmxWLB = 0$ is 0.011.

non-work related demands. Combined, these results show that female entrepreneurs use external digital tools more intensively in their businesses when they face greater non-work related demands, which are heightened in settings that have less institutional support for managing non-work related responsibilities.

Columns 5 to 8 and Panel B of Figures 2 and 3 show that these patterns are similar but less stark for internal digital tools, for which women are likely to face higher adoption costs. 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 5), 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 7 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.[25] Similar to the pattern for external digital tools, the triple interaction in column 8 shows that women who start firms for WLB in low female participation countries are significantly more likely to adopt internal digital tools compared to their female counterparts in high female participation countries. In other words, the gender gap for internal digital 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 constraints raises female entrepreneurs' likelihood of using them in their businesses.

These findings are consistent with our interpretation that entrepreneurs with higher non-work related demands and hence more limited work time will be more likely to adopt digital tools. However, an alternative interpretation to these findings is that female firms that are founded for WLB may reflect a preference for working from home rather than non-work related demands like childcare, and male and female work-from-home businesses may be correlated with differential digital tool use for reasons other than non-work demands. While our results are not inconsistent with the explanation that a WLB founding motivation correlates with a preference for flexibility (which may be due to non-work related demands), we do not think our results are driven by work-from-home type of businesses. To the extent that work-from-home businesses started by women are primarily in retail (e.g., Etsy) or personal services (e.g., beauty and wellness), we replicate Table 3 but drop firms in retail (which include online businesses) and personal services in Table A11 and find similar results.

Taken together, the above results highlight that the founder-specific benefit of digital technology in alleviating time constraints of entrepreneurs is likely to be particularly consequential for female founders

[25] The p-value of $FemaleFirm + FemaleFirmxWLB = 0$ is 0.324.

that face non-work related demands, as they are associated with higher rates of both types of digital tool use. This relationship is particularly pronounced for external digital tools for which female entrepreneurs face fewer adoption barriers, but is also present for internal digital tools that likely require investments in digital skills to adopt. These patterns are in contrast to male entrepreneurs whose technology usage decisions appear less correlated with WLB objectives, suggesting that WLB goals among male founders are less likely to reflect binding non-work related constraints than they are among female founders.

5 Conclusion

We examine the use of digital technology in small businesses and show 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) and this gender gap is present across the world. We do not find evidence that the gender gap in internal digital tool use is primarily due to differences in founding industry or firm characteristics. Instead, we find evidence that suggests differences in digital skills may limit female founders' understanding of the benefits of deploying technology for the management of internal firm activities and their ability to implement them in their businesses. We then show that non-work related demands (measured by whether a founder starts a firm to balance work-life objectives) raise female founders' likelihood of adopting digital tools, including internal digital tools for which they likely face greater adoption costs. 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 suggest that the benefits of digital technology extend beyond the productivity benefits they confer to the firm by 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 that technology adoption can help democratize participation 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 certain 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 debate 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 equitable 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 technologies 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 improving technology literacy of girls and women and educating them on the benefits and use of internal digital tools, such as financial technology. Entrepreneurial training programs, which have been shown to disproportionately benefit women (e.g., Lyons and Zhang, 2017) and confer informational benefits for start-ups (Yu, 2020), 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 are likely other reasons for differences in technology use. For example, more detailed price data of various types of digital tools may better shed light on the extent to which differences in acquisition cost play a role in digital tool use. More generally, data limitations preclude us from drawing causal conclusions on the relationship between WLB founding motivations and digital tool use. 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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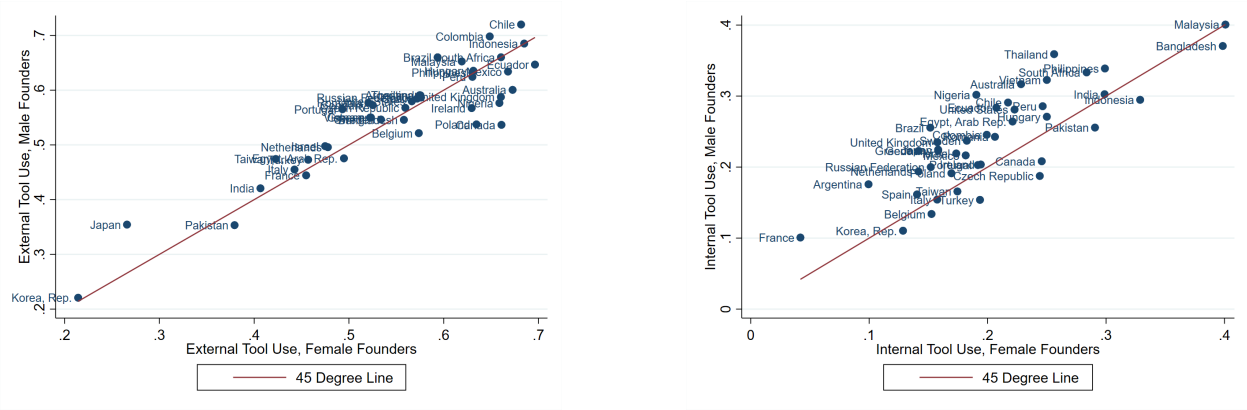
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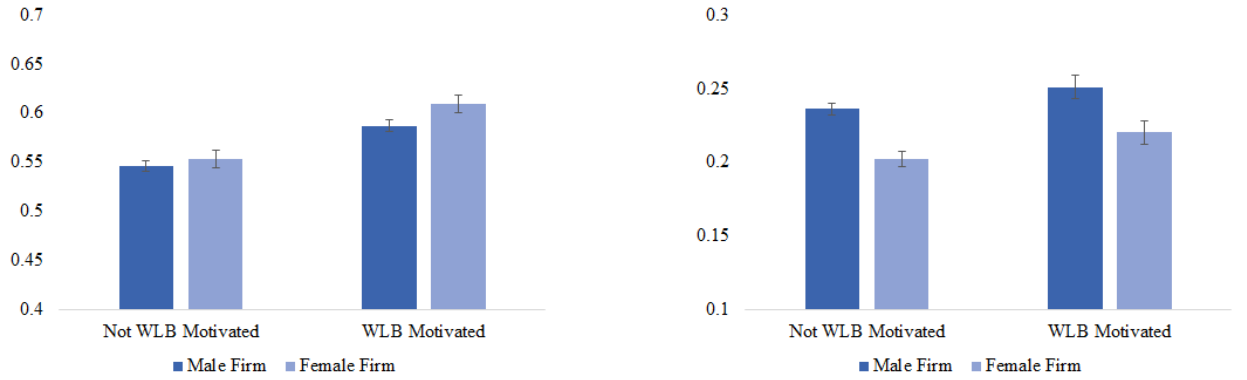
Figure 1: Digital tool use, by country



(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.

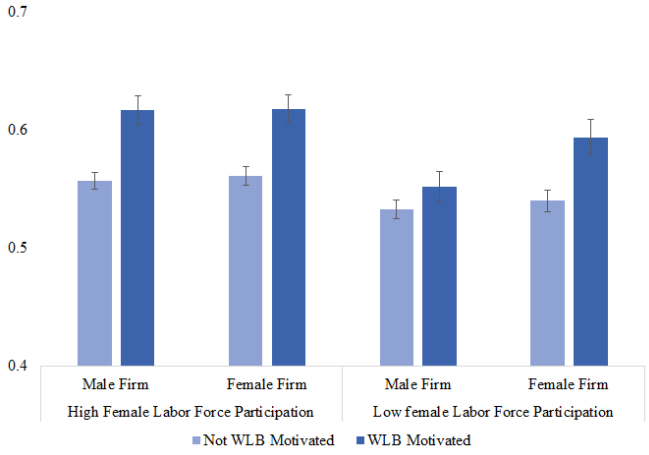
Figure 2: Digital tool use, by gender and WLB founding motivation



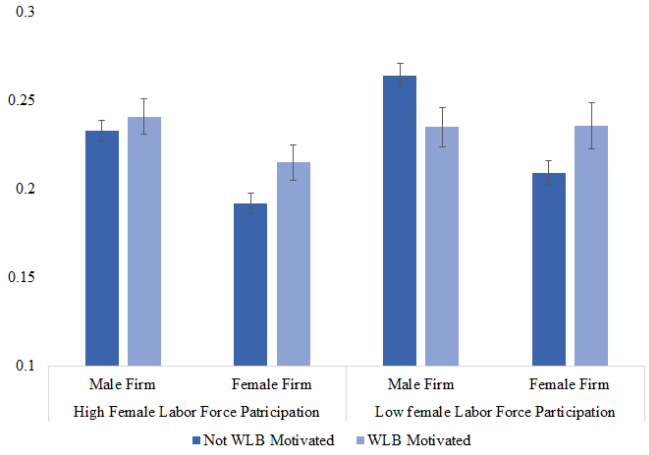
(a) External digital tool use **(b) Internal digital tool use**

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

DV:	External digital tool			Internal digital tool		
Sample:	Full	High equality	Low equality	Full	High equality	Low equality
	(1)	(2)	(3)	(4)	(5)	(6)
Female Firm	0.006	0.015	-0.011	-0.019***	-0.016**	-0.025**
	(0.007)	(0.011)	(0.007)	(0.006)	(0.007)	(0.010)
Single Employee	-0.009	0.007	-0.032	-0.172***	-0.190***	-0.162***
	(0.027)	(0.034)	(0.041)	(0.032)	(0.044)	(0.046)
2-9 Employees	0.032	0.031	0.034	-0.083**	-0.104**	-0.067
	(0.027)	(0.033)	(0.043)	(0.032)	(0.044)	(0.047)
10-49 Employees	0.049	0.060	0.040	-0.006	-0.008	-0.009
	(0.032)	(0.042)	(0.047)	(0.031)	(0.045)	(0.044)
Young Firm	0.041***	0.044***	0.036***	0.012**	0.013	0.011
	(0.008)	(0.011)	(0.011)	(0.005)	(0.007)	(0.007)
VC Financing	-0.039**	-0.077**	-0.018	0.050***	0.035	0.058**
	(0.017)	(0.035)	(0.018)	(0.018)	(0.030)	(0.024)
Observations	23033	13169	9864	23033	13169	9864
R^2	0.097	0.070	0.134	0.080	0.078	0.081

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 splits firms by whether their founding country is above the median gender equality score from the World Economic Forum World Economic Forum (2017) and columns 3 and 6 are countries that are below the median gender equality score. All specifications include industry, country, and year fixed effects. Standard errors clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Digital gender gap in tool use and non-work related demands

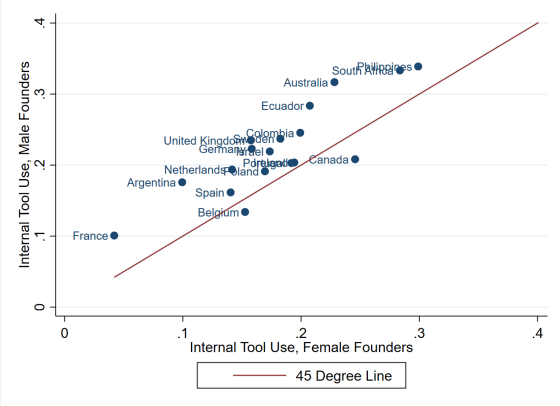
DV:	External digital tool				Internal digital tool			
Sample:	Full sample (1)	High female participation (2)	Low female participation (3)	Full sample (4)	Full sample (5)	High female participation (6)	Low female participation (7)	Full sample (8)
Female firm	-0.002	0.005	-0.013	0.009	-0.021***	-0.024**	-0.017**	-0.022**
	(0.007)	(0.011)	(0.009)	(0.011)	(0.006)	(0.010)	(0.007)	(0.009)
Founded for WLB	0.013	0.061*	-0.038	0.057	0.029	0.081**	-0.026	0.079**
	(0.024)	(0.035)	(0.028)	(0.035)	(0.023)	(0.032)	(0.027)	(0.032)
Female firm x Founded for WLB	0.069*	0.007	0.137***	0.014	0.010	-0.032	0.051	-0.030
	(0.036)	(0.051)	(0.040)	(0.051)	(0.023)	(0.029)	(0.033)	(0.028)
Female firm x Low female participation				-0.024				0.004
				(0.014)				(0.012)
WLB x Low female participation				-0.092**				-0.103**
				(0.044)				(0.042)
Female firm x WLB x Low female participation				0.120*				0.080*
				(0.064)				(0.043)
Observations	23,033	12,904	10,129	23,033	23,033	12,904	10,129	23,033
R^2	0.097	0.081	0.120	0.097	0.080	0.082	0.080	0.080

Note: OLS regressions. The dependent variable of columns 1 to 4 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 5 to 8 is a dummy variable indicating whether the firm reports using internal digital tools. Columns 2 and 6 are sub-samples of firms located in countries with high female labor force participation (World Bank, 2015), and columns 3 and 7 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.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

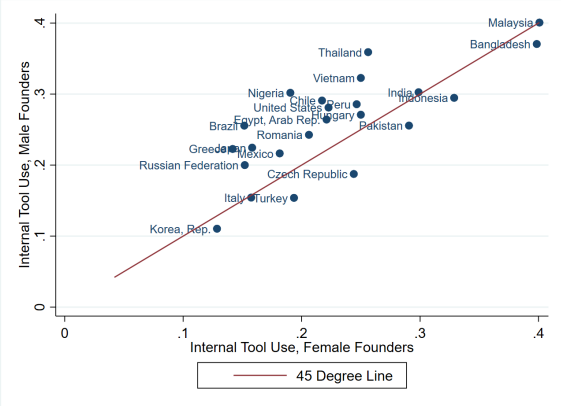
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Appendix A Additional Tables

Figure A1: Use of internal digital tool by gender equality index and gender



(a) Internal digital tool use, above median gender equality



(b) Internal digital tool use, below median gender equality

Note: These figure plots the average use of internal digital tools for male (y-axis) and female (x-axis) entrepreneurs in each country. Panels A and B restrict the sample to countries with above and below median gender equality scores (World Economic Forum, 2017), respectively.

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

(a) Without digital technology

	Total available time = 12 Work time^{Min} = 8	
	Entrepreneur a: Household time demands = 1	Entrepreneur b: Household time demands = 5
Time allocation	Household time = 1 Work time^{Min} $\leq$ Work time $\leq$ 11	Household time = 5 Work time = 7 <Work time^{Min}

(b) With digital technology

	Total available time = 12 Work time^{Min} = 6	
	Entrepreneur a: Household time demands = 1	Entrepreneur b: Household time demands = 5
Time allocation	Household time = 1 Work time^{Min} $\leq$ Work time $\leq$ 11	Household time = 5 Work time = 7 >Work time^{Min}

Note: This table presents two scenarios of how two entrepreneurs that differ in their non-work related activities manage their work demands both in the absence of and with the use of digital technology. Entrepreneur a and b both have a total of 12 hours a day to spend on work and non-work activities. In panel (a), where there is no digital technology adoption, they both need to spend at least 8 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 dedicate 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. In scenario (a), entrepreneur a can meet their minimum work-related demands in order to keep their business afloat; however, 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. In panel (b) where there is technology adoption, the minimum work time needed to keep the business afloat is reduced to 6 hours (e.g., the time it takes the founder to perform key business functions is reduced). Under this scenario, entrepreneur b is able to meet the minimum work time requirements, despite having a higher level of non-work demands.

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: Digital gender gap, by individual external tools

	(1)	(2)	(3)	(4)	(5)	(6)
	External digital tool					Internal digital tool
	Provide info	Show products	Sell products	Communicate	Advertise	Manage internal processes
Female Firm	0.007	0.015**	0.001	0.007	-0.005	-0.019***
	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)
Observations	23033	23033	23033	23033	23033	23033
R^2	0.063	0.067	0.100	0.058	0.052	0.080

Note: This table replicates the results in Table 2 but columns 1 to 5 disaggregates the *External digital tool* measure based on whether the firm uses a digital tool for a specific external facing business function. Column 6 replicates column 2 of Table 2 which indicates whether the firm reports using internal digital tools. All specifications include the firm-level controls included in Table 2, industry, country, and year fixed effects. Standard errors clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Digital gender gap, by industries with high internal digital tool usage

	(1)	(2)	(3)	(4)
	External digital tool		Internal digital tool	
	High internal tool requirement	Low internal tool requirement	High internal tool requirement	Low internal tool requirement
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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: Digital gender gap, by firms that use an accountant for taxation

	(1)	(2)	(3)	(4)
	External digital tool		Internal digital tool	
	Accountant	No accountant	Accountant	No accountant
Female firm	0.001	-0.006	-0.012**	-0.023***
	(0.007)	(0.004)	(0.005)	(0.002)
Observations	45457	284173	45457	284173
R^2	0.079	0.140	0.071	0.126

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 that use an accountant or lawyer for taxation and regulatory compliance and columns 2 and 4 include the subsample of firms that do not. All specifications include the firm-level controls included in Table 2, industry, country, and year fixed effects. Standard errors clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: Digital gender gap, by firms that have VC funding

	(1)	(2)	(3)	(4)
	External digital tool		Internal digital tool	
	VC funding	No VC	VC funding	No VC
Female firm	-0.001	0.006	-0.031	-0.019***
	(0.043)	(0.007)	(0.029)	(0.006)
Observations	881	22150	881	22150
R^2	0.165	0.097	0.157	0.078

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 receive VC funding (3.9% of the sample) and columns 2 and 4 include the subsample of firms that do not. All specifications include the firm-level controls included in Table 2, industry, country, and year fixed effects. Standard errors clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: 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 β $R_{max} = 1.3\tilde{R}$, $\delta = 1$	(6) δ for β=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 β which is produced by $\delta = 1$, and 2) report the value of δ for which the estimator would produce a treatment effect of zero. In the former case, showing that the adjusted β 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 β 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 β is similar to the estimated β with observed controls in column 2. In column 6, we calculate the proportional selection coefficient, δ, 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.

Table A9: Digital gender gap, by firm age

	(1)	(2)	(3)	(4)
	External digital tool		Internal digital tool	
	Firm age > 3	Firm age <= 3	Firm age > 3	Firm age <= 3
Female firm	0.001	0.009	-0.019**	-0.020*
	(0.009)	(0.010)	(0.008)	(0.010)
Observations	11551	11482	11551	11482
R^2	0.097	0.102	0.076	0.092

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 with above sample median age and columns 2 and 4 include the subsample of firms with equal to or below sample median age. All specifications include the firm-level controls included in Table 2, industry, country, and year fixed effects. Standard errors clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A10: Digital gender gap, by share of female graduates that majored in ICT

	(1)	(2)	(3)	(4)
	External digital tool		Internal digital tool	
	High share of female graduates in ICT	Low share of female graduates in ICT	High share of female graduates in ICT	Low 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 share of female post-secondary graduates that majored in ICT and columns 2 and 4 include the subsample of firms with equal to or below median share of female ICT graduates. (OECD, 2016). Note that this data 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.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A11: Digital gender gap in tool use and non-work related demands (without retail and personal services)

DV:	External digital tool				Internal digital tool			
Sample:	Full sample	High female participation	Low female participation	Full sample	Full sample	High female participation	Low female participation	Full sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female Firm	-0.011	-0.012	-0.012	-0.009	-0.016**	-0.018	-0.016**	-0.016
	(0.009)	(0.014)	(0.011)	(0.013)	(0.007)	(0.011)	(0.007)	(0.011)
Founded for Work-Life Balance	0.028	0.098***	-0.041	0.092***	0.039	0.081*	-0.002	0.079*
	(0.027)	(0.033)	(0.035)	(0.033)	(0.028)	(0.043)	(0.031)	(0.043)
Female firm x WLB	0.070	-0.015	0.157**	-0.006	0.021	-0.023	0.067	-0.020
	(0.041)	(0.050)	(0.060)	(0.050)	(0.031)	(0.039)	(0.048)	(0.038)
Female firm x Low female participation				-0.003				-0.001
				(0.017)				(0.013)
WLB x Low female participation				-0.130***				-0.080
				(0.047)				(0.053)
Female firm x WLB x Low female participation				0.159**				0.084
				(0.077)				(0.061)
Observations	16330	9028	7302	16330	16330	9028	7302	16330
R^2	0.095	0.081	0.117	0.095	0.079	0.081	0.081	0.080
Observations	23,033	12,904	10,129	23,033	23,033	12,904	10,129	23,033
R^2	0.097	0.081	0.120	0.097	0.080	0.082	0.080	0.080

Note: OLS regressions. This table replicates Table 3 but drops firms founded in retail (which includes online shops) and personal services. The dependent variable of columns 1 to 4 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 5 to 8 is a dummy variable indicating whether the firm reports using internal digital tools. Columns 2 and 6 are sub-samples of firms located in countries with high female labor force participation (World Bank, 2015), and columns 3 and 7 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.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$