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ABSTRACT

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Key Words: Gender, Entrepreneurship, Self-employment, Internet, Information and communications technology, China

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1. INTRODUCTION

Entrepreneurship, broadly including both high-growth entrepreneurship and self-employment, is an important form of wealth creation for individuals and society at large, yet empirical data have shown that women and men are not equally likely to engage in entrepreneurship (Elam et al., 2019). Achieving gender equality faces significant challenges. The United Nations has recognized gender equality as a crucial goal under the Sustainable Development Goals and has set a target for gender equality and empowerment of all women and girls by 2030. However, despite the efforts made in recent years, gender inequality still exists in various spheres of life, including educational opportunities, economic opportunities, and access to health care. The existence of the gender gap in the rate of entrepreneurship (i.e., the difference in the rate of transition into entrepreneurship between men and women) has motivated substantial research efforts to understand the obstacles faced by women who aspire to become entrepreneurs. The goal of this line of research is to identify potential tools and policies that can help to narrow the gender gap in entrepreneurship (e.g., Jennings & Brush, 2013).

The last two decades of the 20th century saw the rise of important information and communications technology (ICT), such as personal computers, mobile phones, and the internet, which brought fundamental changes to economic productivity and how information is diffused across individuals and organizations (Brynjolfsson & Hitt, 2000). There is empirical evidence, mostly at the regional level, on the relationship between ICT and the rate of entrepreneurship, particularly the role of broadband infrastructure (Ajide, 2020; Audretsch, Heger, & Veith, 2015; Luo et al., 2022), the use of cellphones and the internet (Barnett, Hu, & Wang, 2019), and the impact of online business platforms (Couture et al., 2020; Koo & Eesley, 2021; Pan, Feng, & Zhao, 2022; Zang et al., 2023).

Although it seems evident that the internet has become an important facilitator for entrepreneurial activities, whether use of the internet reduces the gender gap in entrepreneurship is less clear. The most widely cited study on this question is Fairlie's (2006) study, which uses data from the 1997–2001 US Current Population Survey. Yet, the evidence provided in that study is ambiguous. On the one hand, Fairlie finds a positive relationship between ownership of a personal computer and the rate of entrepreneurship, particularly for the women in the sample. On the other hand, the study finds that the relationship between access to the internet and entrepreneurship is weak, negative, and statistically insignificant for both men and women in the sample. These findings may be constrained by the timing when the survey data were collected—it was still the early period of the internet when both the access to

and speed of the internet were limited. While other smaller-scale studies followed (which we will discuss in the next section), we believe there is a need for additional evidence on the relationship between ICT (the internet, in particular, which is the focus of our study) and the differential rate of entrepreneurship between men and women.

Our study aims to expand the empirical evidence on ICT and the gender gap in entrepreneurship beyond the United States. Compared to more developed regions, such as North America and Europe, gender inequality is more prevalent in developing countries. Evidence based on a field quasi-experiment involving women living in 10 villages in rural India shows how the use of ICT can help women launch successful ventures (Venkatesh et al., 2017). At a broader level, one of the major policy goals of the United Nations is to leverage technologies, ICT in particular, in its programs to help address the widespread inequality between men and women in developing countries (UNDP, 2021). We based our study on a nationally representative survey in China to increase the geographical breadth of the existing evidence on the relationship between ICT and the gender gap in entrepreneurship.

We selected China for our study for two reasons. First, research has shown that the gender gap is still prevalent in Chinese society, which is reflected in education, health, access to financing, and many other aspects (Chen, Huang, & Ye, 2020; Hu, Guo, & Ding, 2022; Oksuzyan et al., 2018). According to the *China Statistical Yearbook 2021*, the number of women who have never attended school or have only completed primary school was 1.25 times that of the number of men, and the number of women with a high school education or above was 14 percent lower compared with men. There are also significant gender gaps in the labor market, in labor force participation (Chi & Li, 2014), wages (Iwasaki & Ma, 2020), and entrepreneurship (Shinnar, Giacomin, & Janssen, 2012). Data from the China Family Panel Studies (CFPS) in 2020 show that women's labor force participation rate was 14.5 percent lower than men's rate, and women's rate of entrepreneurship was 8.4 percent lower than men's rate. Overall, gender inequality remains a significant issue in China.

Second, the rapid increase in the penetration rate of the internet among Chinese residents has had a significant impact on the nation's entrepreneurial activities (Barnett, Hu & Wang, 2019; Tan & Li, 2022; Wang, Hu, & Xiong, 2022). According to the Ali Research Institute, more than 1 million farmers engaged in online entrepreneurship on the Taobao platform in 2021. In recent years, live streaming has become a new business model on Taobao, Douyin, Kuaishou, and other digital platforms in China. These live streamers could be regarded as a new type of entrepreneur (Pan, Feng, & Zhao, 2022). Figure 1 shows

the internet's diffusion rate in China, along with the diffusion rates in the United States and the developing and developed regions of the world. In 2010, only about 35 percent of the population in China had access to the internet, which was much lower than the approximately 70 percent rate in the United States. By 2018, the diffusion rate in China had grown to about 60 percent, yet it still lagged behind that in the United States by about 30 percent. Interestingly, the rate of internet penetration in China had not reached a saturation point even by 2020. The pattern is similar in the rest of the world, with most of the developing countries trailing the developed world in the internet diffusion rate.

Figure 2 shows that the distribution of internet access has been uneven between rural and urban regions in China, with the diffusion rate across the rural population being about half the rate across the urban population for most of the years we study. These patterns suggest that compared to the data from the United States and other developed regions (which are featured in a majority of entrepreneurship studies), the Chinese data are better situated for studying our research questions on the relationships between the internet and gender differences in the rate of entrepreneurship.

Insert Figures 1 & 2 about here

In this paper, we address the following issues. First, we evaluate whether internet use is associated with a reduction of the gender gap in entrepreneurship. Second, and more importantly, we compare the observed gender gap–mitigating effect (if any) of internet use across subsets of the sample to assess whether reduction of the gap is more salient among the subgroups facing greater social and economic disadvantages. A study of access to ICT among academic scientists in the United States found evidence that supports the role of ICT as a democratizing force for the more marginalized social groups (Ding et al., 2010). However, it remains unclear whether ICT is related to narrowing the gender gap in entrepreneurship for those subgroups that face more social and economic obstacles. Our second goal is to test this idea. This study aims to contribute to the literature on the interplay between ICT and gender equality, specifically in the context of entrepreneurship, and to provide insights into the potential of the internet as a tool for empowering women and reducing gender inequality.

We analyze the relationships between internet use, gender, and transitioning to entrepreneurship using the CFPS, which is a nationally representative household survey series that is jointly designed and administered by the Institute of Social Science Survey of China at Peking University and the Survey Research Center at the University of Michigan (Xie & Hu, 2014). It follows a similar design as the Panel

Study of Income Dynamics, which is commonly used for studying entrepreneurship in the United States. We follow prior entrepreneurship research using similar data and define entrepreneurship based on an individual's self-reported work status as owning and/or running his or her own business(es). Similar to the US data, the CFPS has a larger representation of self-employment and small-scale startups than high-growth venture capital–funded operations. Using the six available waves of the CFPS survey from 2010 to 2020, we constructed an unbalanced panel dataset of 84,004 individual-year observations for 25,177 unique adult individuals between ages 18 and 65 for our analysis.

As a preview of our results, we observed in our data a narrower gender gap in entrepreneurship among those with more frequent use of the internet than among those with less frequent use. In addition, we found evidence that supports the democratizing role of the internet. Specifically, we observed in our data that the gender gap–mitigating effect of the internet is (a) stronger among the lower educated subgroups of respondents; (b) stronger among respondents who live in regions with a lower level of gender equality, which is reflected in the degree of gender biases and stereotypes against women (e.g., Balachandra et al., 2019; Guzman & Kacperczyk, 2019; Greene, Han, & Marlow, 2013); and (c) stronger for informal entrepreneurship, which exists outside the formal registration system of an economy (Lubotsky & Olson, 2015) than for formal entrepreneurship.

The rest of the paper is organized as follows. Section 2 summarizes relevant literature related to gender and entrepreneurship and develops our hypotheses on the role of the internet in shaping the gender gap in entrepreneurship. Section 3 describes the data, variables, and models. Section 4 presents the results of the empirical tests. The last section concludes and discusses the findings.

2. THEORY AND HYPOTHESES

2.1. Gender Gap in Entrepreneurship

The gender gap has been found in many aspects of social life and its roots can be traced back to gender stereotypes (Eddleston & Powell, 2008; Greene, Han, & Marlow, 2013; Gupta et al., 2009; Ashmore & Del Boca, 1981), which prescribe that women should be nurturing and dependent, while men should be dominant and competitive (Eagly & Steffen, 1984; Eagly, 2013). Traditionally, entrepreneurship has been viewed as a masculine activity (Jennings & Brush, 2013), and thus women are perceived as less likely to succeed in entrepreneurship (Greene, Han, & Marlow, 2013). The existence of this gender gap has been confirmed by research on gender and entrepreneurship (for a review, see Jennings & Brush, 2013). According to the latest Global Entrepreneurship Monitor survey, the average Total early-stage

Entrepreneurial Activity in 2020 was 11 percent for women, which was about three-quarters of the average for men (Elam et al., 2021).

The related literature has identified several types of hurdles that women face in their transition to entrepreneurship. First, entrepreneurial opportunities often emerge while individuals are working for an employer prior to starting their own ventures (Agarwal et al., 2004; Burton, Sørensen, & Beckman, 2002; Chatterji, 2009; Klepper, 2007; Sørensen & Sharkey, 2014). As such, an individual's past work experience and affiliations shape his or her ability to identify promising opportunities for entrepreneurship. Given the widespread gender disparity in wage employment (Guzman & Kacperczyk, 2019), women who aspire to become entrepreneurs often lack the right type of employment background, such as in high-growth areas that would facilitate the identification of promising entrepreneurial opportunities (Loscocco et al., 1991).

Second, women often raise lower levels of financing for their entrepreneurial ventures (Coleman & Robb, 2009) from banks, angel investors, or venture capital investments (Ewens & Townsend, 2020; Guzman & Kacperczyk, 2019; Brush et al., 2002). There may be inherent biases against women among the decision makers in financial institutions (Balachandra et al., 2019; Brooks et al., 2014; Kanze et al., 2018; Lee & Huang, 2018; Stroube, 2021).

Third, past research has shown that women's networks are more constrained than men's (Ibarra, 1992; Singh, Hansen, & Podolny, 2010). Women often lack a diverse pool of high-quality network contacts due to homophily or ecological constraints (Ruef, Aldrich, & Carter, 2003). As such, women often encounter more difficulty in leveraging their social network ties to obtain the resources that are necessary for venture creation. Other factors may also exist as barriers against women's rate of entrepreneurship (e.g., differences in the psychological underpinnings and motivations for entrepreneurship between men and women). Together, given the obstacles identified in the literature, it should not be surprising to find that in general, compared with men, women have a lower rate of participation in entrepreneurship.

In addition to studies of the causes and specific manifestations of the gender gap in entrepreneurship, a few studies discuss how to reduce the gender gap in entrepreneurship. As policy makers have been striving to support women's entrepreneurship as a possible growth driver, researchers have focused on support programs to reduce the gender gap in entrepreneurship (Vossenberg, 2013). For example, Brixiová, Kangoye, and Said (2020) find that entrepreneurial training benefits men but not women entrepreneurs, while tertiary education enhances the impact of financial literacy training on women entrepreneurs. Karlan and Valdivia (2011) find no evidence of the marginal impact of business

training on women entrepreneurs. Another stream of literature explores whether a change in power structures could reduce the barriers to women's entrepreneurship. For example, Lindberg, Lindgren, and Packendorff (2014) find that nongovernmental organizations could bridge the gender gap. Bastida et al. (2020) suggest that cooperatives are especially suitable for women and a favorable format for their entrepreneurial development.

The weight of the empirical evidence has focused on the role of support programs or organizational forms that reduce the gap in entrepreneurship between men and women. Although a few studies suggest that ICT may promote women's participation in entrepreneurship (Venkatesh et al., 2017; Ughetto et al., 2020), the empirical evidence on the relationship between ICT and the gender gap in entrepreneurship is relatively thin. An often-cited study by Fairlie (2006) reveals that among the respondents to the US Current Population Surveys of 1997 to 2001, personal computer ownership was positively associated with the rate of entrepreneurship, with the association being even higher among women. However, the link between the use of the internet and the rate of entrepreneurship is more ambiguous. For example, Fairlie (2006) finds no significant relationship between access to the internet and the rate of entrepreneurship. In contrast, a study of the relationship between the availability of broadband in rural US counties in 2003 and the birthrate of establishments in the subsequent three years finds a positive link (Conroy & Low, 2021), as does a study of the rural population in China in 2014–16 (Barnett, Hu, & Wang., 2019).

The conflicting findings of these studies may be related to the choice of analytical data, which were at different stages of the internet's diffusion and drawn from different populations. Yet, more importantly, the mixed findings also point to the possibility that the role of the internet may diverge across different subpopulations. For example, we surmise that the internet may have changed the opportunity and resource structures *differently* for aspiring male and female entrepreneurs, thus leading to a change in the long-existing gap in the entrepreneurship rate between them—a question that would benefit from more systematic investigation with large-scale data.[1]

2.2. The Internet and the Rates of Entrepreneurship among Men and Women

[1] There are two related studies. Hashim, Razak, and Amir (2011) study post-training venture outcomes of 88 participants in the 1nita program sponsored by the Indonesian government, and Venkatesh et al. (2017) conducted a field quasi-experiment in 10 rural villages in India. Both studies rely on only women participants in their research design.

First, before the dawn of the internet, information on promising entrepreneurial opportunities often emerged from people's work experiences (Agarwal et al., 2004; Burton, Sørensen, & Beckman, 2002; Chatterji, 2009; Klepper, 2007). As women tended to hold jobs that were less conducive to the identification of such opportunities, they faced a disadvantage in opportunity identification. While admittedly this type of disadvantage still exists for women, the internet has expanded the channels for individuals to obtain information that may lead to entrepreneurship. For example, watching movies and videos or even playing games on the internet can expand a person's information channels. Another example is online discussion forums such as Reddit, which are often used as platforms for gathering up-to-date information on products, market demand, and emerging technologies. Although these forums cannot completely replace conventional sources of entrepreneurial information, they serve as supplemental channels for opportunity identification. A major difference between conventional social clubs and these new online forums is that gender attributes may be hidden given the option of anonymity. Such a feature should reduce the hurdle for women to participate in these discussion forums and increase their access to the information circulating on the forums. Our argument is not that men have not reaped benefits from such alternative channels for entrepreneurial opportunity-related information. Instead, our premise is that these internet-based alternative channels for identifying entrepreneurship opportunities benefit women *at a higher rate* than they benefit men, largely due to the removal of gender attributes in many of these internet-based information channels (due to anonymity), which is not feasible in the non-internet world where men and women have in-person interactions. Thus, these internet-based information channels may effectively open up a different route of opportunity identification and reduce women's reliance on the conventional, more male-friendly venues for accessing entrepreneurship-related information.

Second, the internet has also ushered in new forms of entrepreneurial financing. In particular, internet-based crowdfunding as an alternative route for new venture financing has been gaining ground over the past 20 years (Bruton et al., 2015; Lin & Viswanathan, 2016). Different from conventional funding channels, such as bank loans and venture capital, these internet-based crowdfunding platforms appear to favor women's projects over men's, at least for some types of ventures (e.g., Bapna & Ganco, 2021; Greenberg & Mollick, 2017; Stroube, 2021). Although more empirical evidence is needed for a fuller understanding of the existence (or absence) of a gender gap in internet-based venture financing, at a minimum, the research so far has shown that the introduction of internet-based venture financing has

opened up important alternative funding avenues for aspiring women entrepreneurs (e.g., Chen, Li, & Lai, 2017; Gafni et al., 2021; Pellegrina et al., 2017).

Third, women are found to face significant ecological and geographical constraints that contribute to their lower rate of transition into entrepreneurship (Ruef, Aldrich, & Carter, 2003). The internet may help broaden the social and geographical reach of an individual's network (Arenius & De Clercq, 2005; Boeker et al., 2019), and thus it may help women to overcome the network constraint (e.g., Malhotra, Kanesathasan, & Patel, 2012; Venkatesh et al., 2017). For example, before the dawn of the internet, it was challenging to launch entrepreneurial businesses in non-local markets. In the conventional mode of entrepreneurship, women face clear disadvantages relative to men. Given the traditional division of labor within a family, women tend to shoulder more family responsibilities, and as such, they are more geographically tied to their home locations. In contrast, aspiring male entrepreneurs can travel farther from home to cast a wider net for promising entrepreneurial opportunities. Recent research has shown that the internet has been instrumental in expanding the geographical reach of businesses, particularly among businesses that were set up to operate primarily on platforms such as Amazon and Alibaba (e.g., Couture et al., 2020; Koo & Eesley, 2021). Many of these platform-based e-commerce businesses can be conducted at home, allowing women to work for their venture while caring for their family. Therefore, in the era of the internet, while admittedly both men and women may benefit from the wider geographical opportunities it offers, we surmise that the relative benefits should accrue at a higher rate to women than to men given women's more disadvantaged positions before the internet was created. This again helps to remove the ecological and geographical constraints that prior research has identified as among the major hurdles for aspiring women entrepreneurs, by facilitating expansion into distant geographical markets via e-commerce platforms.

To summarize, we expect that the internet helps women more than men to gain access to information on business opportunities, obtain financial support, and overcome disadvantaged networks in their transition to entrepreneurship. Therefore, we hypothesize the following:

> *Hypothesis 1 (H1): Internet use mitigates the gender gap in entrepreneurship: the gap (or the difference) between men's and women's rates of entrepreneurship is narrower among individuals who use the internet more frequently than among individuals with use it less frequently.*

We take H1 as the starting point and next ask the following: is the internet a potentially

democratizing force that narrows the gender gap in entrepreneurship among individuals who are more socially and economically disadvantaged?

For this question, we draw from existing research that has demonstrated the equalizing effect of ICT on the productivity of disadvantaged groups. In particular, Ding et al. (2010) study the adoption of the early generation of ICT technologies Bitnet and Domain Name System in US universities. These technologies are usually considered to have been the precursors of email and the internet. Ding et al. (2010) observe differential effects of the adoption of these two early-generation ICT technologies on the productivity and collaboration patterns of different subgroups of academic scientists in the United States: the relatively disadvantaged subgroups, namely, women and scientists who were affiliated with less prestigious universities, benefited *more* from the adoption of these ICT innovations. The findings point to the possibility that the equalizing effect of ICT manifests more strongly among the more disadvantaged subgroups in society given its ability to enable better access to information beyond what conventional social and economic structures allow for those disadvantaged subgroups.

This dynamic is likely to manifest in entrepreneurship as well. Successful entrepreneurship requires considerable resource mobilization. At a broad population level, resource constraints have already limited women's entrepreneurship for the reasons discussed above. For women in the more marginalized social subgroups (e.g., those who are lower educated and/or face inequitable treatment in their environment), the constraints they face are likely even worse. For example, in more marginalized social subgroups, such as those with less education, societal norms tend to be even more unfavorable for women aspiring to launch entrepreneurial ventures. The onset of the internet may have potentially lessened the constraints of the unaccommodating social and resource environments facing women in the disadvantaged groups (more than it does for men). For example, as the internet breaks down geography-based information barriers for those who are lower educated or living in areas with high levels of gender inequity, residents in these subgroups may have the opportunity to learn about different gender norms via the internet that were previously not available in their local environment. As such, the internet may bring greater changes to the entrepreneurial environment facing the more disadvantaged subgroups. Following this direction, we propose that *the gender gap–mitigating effect of the internet on rate of transition to entrepreneurship should be stronger among the subsample who previously faced greater disadvantages* (i.e., subgroups of women who likely suffered from information and communication barriers due to their social and economic positions in society).

We focus on three attributes to identify the disadvantaged subgroups. First, substantial research

has linked individuals' level of education to their career achievement and attainment of socioeconomic status. Lower education has also been linked to a lower likelihood of becoming an entrepreneur (De Clercq & Arenius, 2006; Manolova et al., 2007; Robinson & Sexton, 1994). As the subgroup of lower educated women is more likely to occupy marginalized positions in society and face more barriers in the transition to entrepreneurship, we draw from the argument that ICT is democratizing (Ding et al., 2010) and expect that these women stand to benefit more from improved access to information through use of the internet. Therefore, we expect the following:

> *Hypothesis 2 (H2): The gender gap–mitigating effect of the internet on the rate of entrepreneurship (stated in H1) is stronger for individuals with a lower level of education than for individuals with a higher level of education.*

Second, geographical regions differ in their degree of gender equality in everyday work and life (Shaffer et al., 2000), which presumably is reflected in the level of support that an aspiring woman entrepreneur receieves from her local environment. In environments where the level of gender equality is low, there may be stronger gender biases and stereotypes against aspiring women entrepreneurs, leading to greater difficulty in obtaining the necessary resources and support (e.g., Balachandra et al., 2019; Guzman & Kacperczyk, 2019; Greene, Han, & Marlow, 2013). As the internet breaks down geographical barriers and allows information about entrepreneurial opportunities, financing, and other entrepreneurial resources to reach individuals living and working in regions characterized by a lower level of gender equality, we surmise that women in those regions should benefit more from access to the internet than their counterparts living and working in regions with more gender equality. As such, we expect the following:

> *Hypothesis 3 (H3): The gender gap–mitigating effect of the internet on the rate of entrepreneurship (stated in H1) is stronger for individuals in regions with a lower level of gender equality than for individuals in regions with a higher level of gender equality.*

Third, we explore which types of businesses are expected to see a stronger gender gap–mitigating effect of the internet on entrepreneurship. Following previous studies (Autio & Fu, 2015; Moore, Dau, & Doh, 2020), we differentiate startups between informal and formal businesses. Informal businesses are those that are formed outside the formal registration system of an economy (Lubotsky & Olson, 2015). As these businesses operate outside the formal institutional frameworks, they tend to be smaller, nimbler, and less costly to start up (Bennett, 2010; Rauch, 1991). Informal businesses have been found to be an important source of entrepreneurship and a driver of economic growth in developing countries (Autio & Fu, 2015). They are particularly important for the subgroups of society who are in more disadvantaged

positions, as these subgroups often lack sufficient resources for starting up formally registered ventures.

We propose that use of the internet has a more salient effect on narrowing the gender gap in entrepreneurship among those who are starting informal businesses than those who are starting formal businesses. This is because formal businesses incur much higher costs, such as payroll and regulatory compliance, which naturally demand more resources in the startup process (Hinson, 2011; Pellegrina et al., 2017). Only entrepreneurs who possess higher levels of social and economic resources can afford to start their businesses formally, particularly in countries with lower quality economic and political institutions (Autio & Fu, 2015). Although the internet can reduce information and communication barriers, it is not known to be effective in reducing the costs associated with entrenched institutional requirements. This implies that for women aspiring to formal entrepreneurship, there is less room for them to leverage the benefit of the internet to overcome barriers within the existing the institutional framework. Therefore, we expect the following:

> *Hypothesis 4 (H4): The gender gap–mitigating effect of the internet on the rate of entrepreneurship (stated in H1) is stronger for informal entrepreneurship than for formal entrepreneurship.*

3. METHODS

3.1 Data Sources

We tested our theory with data from the CFPS from 2010 to 2020 on Chinese residents' entrepreneurship activities and internet use in. The CFPS is a well-designed, high-quality, nationally representative survey project with an impressive 84 percent initial response rate. The data are publicly available to the research community.[2] Although the dataset is relatively new to the public, it has already been used by researchers to study important questions such as labor force participation patterns (e.g., Chen & Ge, 2018), household consumption (e.g., Chen, Hardin III, & Hu, 2020), mental health (e.g., Hsieh & Qin, 2018; Zhang, Zhang, & Chen, 2017), and entreprenurship (Barnett, Hu & Wang, 2019; Tan & Li, 2022; Xie, Li, & Zhou, 2023). The CFPS contains rich information on individuals' demographic characteristics, career choices, and household characteristics.

Six waves of data are available for public use (2010, 2012, 2014, 2016, 2018, and 2020) and we used all six waves for our analysis. Following prior research (e.g., Hechavarría, Matthews, & Reynolds, 2016; Reynolds et al., 2004; Schjoedt & Shaver, 2007), for the sample, we only retained individuals who

[2] Details about the survey are available at https://opendata.pku.edu.cn/dataverse/CFPS?language=en.

were between ages 18 and 65 years for our analysis of entrepreneurship activities. We further restricted the sample to individuals who have appeared in at least two consecutive waves (due to the variable lagging requirement in our models). After eliminating observations with missing values, our analytical sample consists of unbalanced panels of 84,004 person-year observations for 25,177 unique individuals. Table A11a provides an explanation of the steps we followed for sample construction, and Table A11b shows the number of observations in each wave of our sample.

In addition to the CFPS, we obtained province-level variables from the *China Regional Statistical Yearbooks* and *China Province Statistical Yearbooks* (National Bureau of Statistics of China, 2011, 2013, 2015, 2017, 2019, & 2021).

3.2. Variables

Insert Table 1 about here

Table 1 provides definitions of the variables we used in our analyses.

Dependent variables. Our main dependent variable, *Entrepreneurship,* is coded as 1 if a respondent self-reported for that year as self-employed or running his or her own business in a non-agriculture sector, and is coded as 0 otherwise. This measurement follows the conventional measure of entrepreneurship that has been broadly used in prior research on entrepreneurship (e.g., Block & Sandner, 2009; Hamilton, 2000; Zhao, 2020).

To test Hypothesis 4, we differentiated between formal and informal entrepreneurship. We categorized *formal entrepreneurship* as the startup of a venture that provides social insurance to its employees. In contrast, informal entrepreneurship refers to the startup of a venture that does not provide social insurance to its employees, or self-employment without employees. In China, all formally registered businesses are legally required to provide their employees basic social insurance, including endowment insurance, medical insurance, workplace injury insurance, unemployment insurance, and maternity leave insurance—a suite of insurance programs that serve similar purposes as Social Security and Medicare in the United States. Because the provision of social insurance increases employers' labor costs, businesses that are not properly registered often find ways to avoid it. Therefore, whether or not a business makes payments into the employee social insurance programs can be used to distinguish whether a startup venture is a formal or informal business.

Independent variables. Our main independent variable, *woman*, is coded as 1 if the respondent self-reports his or her gender category to be woman, and is coded as 0 otherwise. The gender gap in entrepreneurship is assessed through the coefficient estimate for the variable *woman*. We do not directly estimate the gender gap in entrepreneurship in our main tables; however, Table A2, in the Appendix, provides the gender gap coefficient.

Another main independent variable is the *frequency of internet use*. The survey respondents were asked the following: "In general, how frequently do you use the internet for [activities]?" The activities included study, work, socializing, entertainment, and commercial-related activities (e.g., online banking, shopping, etc.). We did not differentiate across types of activities in our main analyses, because all the activities may influence the way individuals access information for entrepreneurship. For example, entertainment and commercial-related activities may be interpreted as leisure-seeking and nonrelevant to entrepreneurship. Yet, such activities may be viewed as the avenues through which aspiring entrepreneurs find business ideas or change their perceptions about the value of entrepreneurship. Socializing activities may be venues for finding collaborators for entrepreneurship. We also did not find any clean correspondence from a specific activity to a certain mechanism underlying the transition to entrepreneurship. For these reasons, we find it more reasonable to treat these activities in totality in our measure.[3]

Our measure of internet use (both the frequency and the dichotomous measure) reflects the extent to which a respondent has access to the internet regardless of the hardware she or he uses. The respondent may access the internet via a personal computer or via a smartphone. We do not differentiate between the two (or any other) hardware choices for accessing the internet as our theoretical interest lies more in the way that access to information has been changed through the internet, rather than in the effect of specific hardware, which may be a good subject for a different study.

For each activity type, the respondents were provided seven options: (1) every day, (2) three or four times per week, (3) one or two times per week, (4) two or three times per month, (5) once per month, (6) once in a few months, and (7) never. We reverse-coded the Likert scale so that a higher numbered

[3] We also ran additional analyses replacing the all-activity frequency of internet use measure (which we use in our main tables reported in the paper) with single-activity-based measures. With the exception of study-related internet use, the results are largely similar across the types of activities and similar to the results obtained with the all-activity-based measure. Using an internet use frequency measure *without* accounting for study-related activities does not change our main results. For simplicity, we report in the main tables only the findings for the all-activity-based measure of frequency of internet use.

choice indicates a higher frequency of use.[4] We then took the mean of the frequencies across the different types of internet-related activities to obtain the *frequency of internet use* measure for our analyses. We also used an alternative, which is a dichotomized "use internet" (or not) measure that is coded 1 if the respondent's answer to the question "Do you use the internet?" was "yes."

Hypotheses 2 and 3 are about how the association between internet use and entrepreneurship differs by the levels of education and local gender equality. We measured *education* as the total number of years of schooling that a respondent had received.

For our gender equality measure, we first obtained a measure of gender inequality that is based on the degree of gender biases and stereotypes in a region. In the CFPS questionnaires, the respondents were presented statements related to gender stereotypes and asked to rate the extent to which they agreed with each of the statements. These statements covered four dimensions: division of labor between men and women, women's marriage, women's children, and division of housework between men and women. Examples of these statements include "Men prioritize career over family, while women prioritize family over career" and "A woman's success is less important than marrying well." A higher degree of agreement with these statements indicates that a respondent holds stronger gender stereotypes and is more biased against women. For our regression analysis, we reverse-coded the raw measure, then calculated the average score of the respondents' ratings of these statements at the province-year level to capture the level of *gender equality* in a region.

Control variables. Following prior research, we included individual, family, and regional-level control variables that may influence the likelihood of entrepreneurship. At the individual level, demographic characteristics are believed to be important predictors of entrepreneurship (Lévesque & Minniti, 2011; Lofstrom, Bates, & Parker, 2014). We controlled respondents' *age*, which is a key component of human capital that influences an individual's likelihood of entrepreneurship (Parker, 2004; Zhang & Acs, 2018). We included *marital status* and *number of children*, as a large body of studies show that entrepreneurial propensity is associated with being married and having children (Simoes, Crespo, & Moreira, 2016). Prior studies have indicated that political connections have an important impact on entrepreneurial activities in China (Ge et al., 2017; Li, Meng, Wang, & Zhou, 2008). Therefore, respondents' *political connection* is included as a control as well, which is coded as 1 if the respondent is a

[4] In the 2010 wave survey, the Likert scale had five options, which we standardized into a seven-option scale to make the measurement comparable across survey waves.

member of the Communist Party or Communist Youth League, and 0 otherwise. Further, entrepreneurial propensity differs between rural and urban regions (Reynolds, Storey, & Westhead, 1994). We also controlled respondent location—*urban* region is coded as 1 if the respondent lives in an urban area, and 0 otherwise.

Family-level factors also play an important role in individuals' decision about entrepreneurship (Aldrich & Cliff, 2003; Chen & Hu, 2019; Jennings & McDougald, 2007). The support of family funds is crucial for entrepreneurs, and the financial capital accumulated by the family can help with individuals' entrepreneurial activities (Dunn & Holtz-Eakin, 2000). Thus, we controlled several variables that indicate the financial condition of the respondent's family. Specifically, we controlled *family deposit*, which is the amount of total household bank deposits in the year. *Family income* is the total household income in a given year from all sources after taxes and other deductions were made. *Loan from bank* is the amount of bank loans (except house mortgages) that remain to be paid by the respondent's family. *Loan from private sources* is the amount of family loans from relatives, friends, and organizations other than banks. *Financial product* is the value of the household's financial investments, including stocks and funds. All the family-level variables were log-transformed when they were entered into the models.

In addition, the external environment is a critical antecedent of entrepreneurship (Acs, Desai, & Hessels, 2008; Chen & Hu, 2019; Yang & Li, 2008). At the regional (province) level, we controlled four variables on the local environment that may influence individuals' entrepreneurship: *population density, number of privately owned industrial enterprises, average wage, and gross domestic product (GDP) per capita in the province*. Population density is an important environmental factor that can affect the knowledge spillover and entrepreneurial activities in a region (Tavassoli, Obschonka, & Audretsch, 2021). More enterprises in a region help form enterprise clusters, which in turn have a positive impact on follow-on entrepreneurship (Delgado, Porter, & Stern, 2010). In addition, the average wage and GDP per capita are important indicators of economic development in a region, which may influence entrepreneurial activities (Acs, Desai, & Hessels, 2008). Similar to family-level variables, the regional controls were logged.

To tease out contemporaneous factors influencing entrepreneurship, we included year fixed effects in all the models. In addition, we included city fixed effects and city-year fixed effects in all the models to tease out the influence of time-invariant factors at the city level.

3.3. Model Specification

We used the linear probability model with individual fixed effects to test our hypotheses. An alternative would be to use a logit or probit model for our dichotomous dependent variable, but fixed-effect logit or probit will cause significant loss of data points since all the respondents whose dependent variable has not changed in value across panels would be dropped.

Another consideration in model choice is that our main independent variable of interest, *woman,* is time-invariant, which would be dropped in the individual fixed-effect model. The trade-offs of using an individual fixed-effect estimator are that we would lose the estimates on the main effect of the *woman* variable. Nonetheless, we believe that using the fixed-effect model provides more conservative estimates as this model helps to control time-invariant heterogeneity across individuals.

In our robustness tests, we also test our models with the random-effects logit model specification. Our results are largely consistent between the fixed-effect linear probability specifications (see section 4.3 for details).

Our models include an extensive list of individual, family, and regional control variables to account for heterogeneity across individuals that may confound our estimates of the effects of gender and frequency of internet use. We also include location (city) fixed effects, year fixed effects, and location and year fixed effects to alleviate unobserved time-invariant heterogeneity that is constant at the city level and overall time trends. As such, our main linear probability estimation model (reported in Tables 3 to 6) follows Equation 1:

$$Entrepreneurship_{ij,t+1} = \beta_0 + \beta_1 Frequency\ of\ Internet\ use_{it} + \beta_2 Woman_i \times Frequency\ of\ Internet\ use_{it} + \beta_3 X_{ijt} + \eta_i + \delta_t + \gamma_j + \delta_t \times \gamma_j + \varepsilon_{ijt} \quad (1)$$

where *Entrepreneurship* denotes whether individual *i* in city *j* in survey year *t+1* self-reported in the survey as an entrepreneur or not, *X* is a vector of control variables at various levels, η_i is the individual fixed effect, δ_t is the year fixed effect, and γ_j represents the city fixed effect. All time-varying independent variables lag the dependent variable by one survey period (two years). Individual fixed effects are included in the linear probability models. We use an individual-level measure (it) rather than a regional-level (jt) measure to investigate the effect of frequency of internet use on entrepreneurship, which allows us to analyze the relationship between internet use and entrepreneurship in a more fine-grained way.

In our robustness checks (reported in Tables A2 to A6, in the Appendix), we also estimated a random-effect logit model following Equation 2. The notation in Equation 2 follows that in Equation 1,

with individual fixed effect term η_i dropped.

$$log\left(\frac{Prob(Entrepreneurship_{ij,t+1}}{1-Prob(Entrepreneurship_{ij,t+1}}\right) = \beta_0 + \beta_1 Frequency\ \ of\ \ Internet\ \ use_{it} + \beta_2 Woman_i \times Frequency\ \ of\ \ Internet\ \ use_{it} + \beta_3 X_{ijt} + \delta_t + \gamma_j + \delta_t \times \gamma_j + \varepsilon_{ijt} \quad (2)$$

We performed all the estimations using STATA 16 software.

4. RESULTS

4.1 Main Results

The descriptive statistics are provided in Table 2 and the variable correlation matrix is provided in Table A1, in the Appendix. About 9.5 percent of the individuals in our sample are entrepreneurs. Among these entrepreneurs, 15.7 percent are running a formal business. Women account for 52.5 percent of our sample. Measured on a scale from 1 (never) to 7 (every day), the average frequency of internet use is 2.04, which is around the level of once in a few months. This low average frequency of internet use suggests that internet use was not yet saturated in our data during our analytical period. Many of the less developed regions in China had only limited access to the internet. This is also revealed in the "use internet" indicator variable—only about one-third of the person-year observations in our sample had access to the internet.

Insert Table 2 about here

Table 3 reports the fixed-effect linear probability model estimates following Equation 1. Model 1 includes the base set of controls as well as year fixed effects, city fixed effects, and city-year fixed effects. In model 2, we add the frequency of internet use variable, which by itself does not show any relationship with the rate of entrepreneurship. However, when we interact frequency of internet use with gender in model 3 to test Hypothesis 1, the results suggest that the gap between men's and women's probabilities of entrepreneurship becomes narrower as individuals' frequency of internet use increases. The positive and significant interaction term lends support to Hypothesis 1. The effect is illustrated in Figure 3, which reveals that for men in the sample (the blue solid line), the association between internet use and entrepreneurship is weak, as reflected by the almost flat slope. In contrast, for women (the red dotted line), there is a clear positive slope of association between frequency of internet use and probability of entrepreneurship. Figure 3 also shows that the gender gap in the probability of entrepreneurship is wider

among individuals with a lower level of internet use. Each additional Likert-scale increase in frequency of internet use is associated with narrowing the gap between the genders by 0.9 percent (Model 3, $p<0.01$). Each one standard deviation increase in the frequency of internet use is associated with a 1.5 percent (=0.009*1.668, Model 3) reduction of the gender gap. In models 4 and 5, instead of the Likert-scale measure of frequency of internet use, we use a dichotomous measure of internet use (yes or no). The results in these two models show that access to the internet is associated with a narrower gender gap in entrepreneurship by 2.7 percent (=0.027, Model 5). Based on these results, we find support in our data for Hypothesis 1 that the gender gap in entrepreneurship is narrower among individuals who use the internet more frequently.

Insert Table 3 and Figure 3 about here

In Table 4, we test Hypothesis 2 that internet use has a stronger gender gap–mitigating effect for individuals with a lower level of education than for individuals with a higher level of education. In model 1 in this table, we ran a three-way interaction of an individual's gender ("woman"), frequency of internet use, and his or her level of education (measured by years of schooling). The result confirms Hypothesis 2—the lower the level of education is, the stronger the gender gap–mitigating effect of frequent internet use is, as indicated by the negative and statistically significant three-way interaction coefficient in the model (-0.002, $p<0.01$, in model 1). For ease of interpretation, we followed the conventions in prior research (e.g., Du, Kim, & Aldrich, 2016) and split the sample by the median level of education (nine years of schooling) and ran the analysis separately for the above-median sample and the below-median sample. The findings are illustrated in Figure 4. In the figure, the gender gap–mitigating effect of the frequency of internet use is reflected by the convergence of the lines for men and women. The convergence trend is only salient for individuals who have had less education (below junior high school), while the slopes for men and women with more education (above junior high) remain mostly parallel to each other. These findings lend support to Hypothesis 2 that the gender gap–mitigating effect of internet use on the rate of transition to entrepreneurship is stronger for lower educated individuals.

Insert Table 4 & Figure 4 about here

In Table 5, we test Hypothesis 3 that the gender gap–mitigating effect of frequent internet use is stronger for individuals in regions with a lower level of gender equality than for those in regions with a

higher level of gender equality. The hypothesis was again confirmed. In model 1, we test this hypothesis with the three-way interaction of an individual's gender ("woman"), frequency of internet use, and the level of gender equality in the respondent's region. The negative and marginally significant three-way-interaction coefficient (-0.015, $p<0.1$, in model 1) suggests supportive evidence. The pattern is clearer in the median split analysis in models 2 and 3. We split the sample by the median value and ran separate models for individuals who live in regions with above-median-level gender equality and for those who live in regions with below-median-level gender quality. The results are illustrated in Figure 5. For individuals living in regions with above-median gender equality, the association between frequency of internet use and probability of entrepreneurship is almost the same (as reflected by the parallel slopes) for men and women. The converging trend between men's and women's rates of entrepreneurship (indicating a narrowing of the gender gap) as their internet use increases is only observed for respondents living in regions with below-median level of gender equality. Therefore, Table 5 and Figure 5 support Hypothesis 3 that the gender gap–mitigating effect of internet use is stronger for individuals living in regions with a lower level of gender equality rather than for those in regions with a higher level of gender equality.

Insert Table 5 & Figure 5 about here

In Table 6, we test Hypothesis 4 that the gender gap–mitigating effect of frequent internet use is stronger for the transition into informal entrepreneurship than for the transition into formal entrepreneurship. In model 1 in this table, we replicate the main regression in Table 3 (model 2) for formal entrepreneurship (when the ventures founded by a given respondent pay for social insurance for their employees). In this model, entrepreneurs who have transitioned into informal entrepreneurship are dropped from the analysis. In model 2, we replicate the main regression in Table 3 (model 2) for informal entrepreneurship (when the ventures founded by a respondent do not pay for social insurance for their employees). In this model, entrepreneurs who have transitioned into formal entrepreneurship are dropped from the analysis. The interaction effects of woman and frequency of internet use are illustrated in Figure 6. The figure shows a slightly wider gap in the probability of formal entrepreneurship among those who use the internet more frequently. In contrast, for informal entrepreneurship, the convergence pattern between the genders that we saw in Figure 3 still exists. Together, the tests in Table 6 and Figure 6 (based on Table 6) provide support for Hypothesis 4 that the gender gap–mitigating effect of internet use is stronger for informal entrepreneurship than for formal entrepreneurship. We also conduct multinomial

analysis of different types of entrepreneurship in the robustness test section and find consistent results (see Table A6, in the Appendix).

Insert Table 6 & Figure 6 about here

4.2. Endogeneity Concerns and Estimation with Instrumental Variables

In the estimation of the relationship between internet use (or broadly, ICT) and entrepreneurship, endogeneity may lead to spurious results. However, in our tests, there is less concern about this because our main interest is not the relationship between internet use and entrepreneurship per se. Instead, our interest lies in how internet use *differentially* affects the rate of entrepreneurship among men and women. As such, even if we assume endogeneity exists between internet use and entrepreneurship that causes the estimated magnitude of the effect of internet use on entrepreneurship to be biased (e.g., upwardly biased), the bias would not affect our estimation of internet use as a factor moderating the gender gap as long as the (presumed) biases are distributed equally between men and women. Put differently, the most relevant concern about endogeneity in our estimation is the possibility that the patterns of internet use may be different across gender in a systematic way, such as if the slope (between internet use and entrepreneurship) is biased toward one gender over the other.

For example, a common concern is that investment in the internet or ICT (and their availability) in a given locality may be driven by investors' projection of the future rate of entrepreneurship in the locality. This type of reverse causality would be relevant to our estimation if the investment was driven by the *gendered* rate of entrepreneurship (e.g., investment being made because there is a higher rate of women's entrepreneurship). This was unlikely to be the case when the government and private investors made their ICT investment location and timing decisions. The development of the broadband infrastructure across localities in China involved significant investment of public resources, and we have *not* found any evidence in the media or academic research that projections of the gender differences in entrepreneurship influenced the ICT investment decisions of the central or local governments.

Another potential concern is related to omitted variables that may drive both the rate of entrepreneurship and ICT. Similarly, such an omitted variable bias only matters to our estimation when it affects men and women differently. That is, our estimates would be biased if men's and women's internet use reflected some unobserved (and uncontrolled) differences between them that were related to entrepreneurship (e.g., their attitude about work effort). To alleviate such concerns, we use two different

approaches in the following instrumental variable (IV) analysis.

Insert Table 7 about here

First, we employ the "Broadband China" policy as our IV. The Ministry of Industry and Information Technology and the National Development and Reform Commission selected 120 cities in three batches from 2014 to 2016 to participate in the "Broadband China" strategy. The purpose was to promote the coordinated development of regional broadband networks, accelerate the optimization and upgrading of broadband networks, and improve the application of broadband networks in these regions. Many studies have used the "Broadband China" policy as a quasi-natural experiment or policy shock that affected internet penetration rates (e.g. Li, Li, & Yang, 2022; Zhong et al., 2022; Luo et al., 2022). The "Broadband China" policy strengthened the construction of internet infrastructure and helped to improve the local internet penetration rate, and it is unlikely that participation-location choices in the Broadband China Project were influenced by gender-related variables. Therefore, we use this policy as an instrument for individual internet use.

Table 7a presents the results of IV linear probability regression with *Broadband China* instrumenting for *frequency of internet use*. Because our endogenous variable, frequency of internet use, is part of an interaction term, fitted values were generated for both frequency of internet use and the interaction between frequency of internet use and woman in the first stage of the IV regression and then entered in the second stage (Bun & Harrison, 2019). The results in Table 7a are consistent with what we found in model 3 in Table 3 on the mitigating effect of the frequency of internet use on the gender gap in entrepreneurship (β=-0.027, $p<0.01$).

Second, we followed the IV approach used in Barnett, Hu and Wang (2019). In their study, they adopted an IV variable that is the local-level aggregate information on the rate of internet use, which has been used in several of the papers cited by Barnett, Hu, and Wang. The rationale is that internet use is influenced by network externality and thus a higher level of local aggregate internet use should be positively related to individual use. Following Barnett, Hu, and Wang's study, we constructed an aggregate local (city) level internet use measure and use it as an instrument for individual internet use. We report the two-stage least squares estimation results using this IV in Table 7b, and the results again confirm the main patterns reported in Table 3.

4.3. Additional Robustness Checks

We conduct two additional sets of robustness tests. In one set, we use random-effect logit models (following Equation 2), which allow us to see the effect of gender on the likelihood of entrepreneurship. In the second set, we use a Cox proportional hazard model specification, which estimates a respondent's hazard of his or her *first* transition into entrepreneurship. Below we explain the rationale underlying each of these two sets of robustness tests and their main results.

First, we use an alternative estimator of the logit model with random effects such that we can estimate the effect of gender on the likelihood of entrepreneurship. We report replications of our Tables 3 to 6 with the random-effect logit estimator in Tables A2 to A5, which show results that are largely consistent with those reported in Tables 3 to 6. In an additional set of robustness tests, we estimate random-effect linear probability models and the results are similar as well (results are available upon request).

Second, we replicate our core models with a Cox proportional hazard estimator. In our main models, we measured a respondent's state of entrepreneurship based on his or her answer to the employment status question in a given year. A small number of individuals (3,258 respondents, pertaining to 6,373 observations) reported that they were an entrepreneur in the first few waves of the survey and remained as an entrepreneur in the rest of survey waves. By using the Cox proportional hazard model, we set an individual's clock in the data as starting from the first year he or she enters the dataset and being at risk for transitioning into entrepreneurship as long as he or she has *not yet* become an entrepreneur. Once a respondent reports his or her work status as an entrepreneur in a given year, we remove that respondent's observations for subsequent years from the analysis. In nutshell, the Cox model only counts one entrepreneurial transition episode for each individual, and an individual who has already transitioned into entrepreneurship will no longer be in the risk set. The replication of Tables 3 to 6 with the Cox proportional hazard estimator is reported in Tables A7 to A10 and most of the results are consistent with what has been reported in our core tables.

5. CONCLUSION AND DISCUSSION

Our study was motivated by the following question: given our understanding of the gender gap in entrepreneurship, what tools could possibly change (narrow) this gap? We were inspired by recent research that focused on the role of technology, in particular ICT, which presumably helps to break down communication barriers and facilitate the transmission of information to communities that have

historically suffered from an information disadvantage (Ding et al., 2010; Venkatesh et al., 2017). We hypothesized that an increase in the level of access to and usage of ICT such as the internet should help aspiring female entrepreneurs more than it helps male entrepreneurs, and as such result in a narrower gender gap in entrepreneurship. We further hypothesized that any observed ICT effect in mitigating the gender gap in entrepreneurship should be stronger for the subpopulation of women who are in a more disadvantaged position in society.

We tested these ideas on a novel CFPS dataset and analyzed 84,004 person-year observations for 25,177 individuals residing in China from 2010 to 2020. The empirical evidence confirmed all of our hypotheses. First, we found that internet use is associated with a narrower gender gap in the probability of entrepreneurship. The extent to which the gender gap is narrowed is quite substantial: having access to the internet is associated with an absolute reduction of the gender gap in the probability of entrepreneurship by 2.7 percent. These results are nontrivial. With China's population of 1.4 billion in 2020, the overall entrepreneur population was 133 million (9.5 percent, based on sample mean, Table 2). Without Internet access, women's rate of entrepreneurship trailed that of men's by 31 percent (=exp[-1.148], Model 2, Table A2), which means 41 million less women entrepreneurs. With access to the Internet, the gap between men and women entrepreneurs was reduced by 1.1 million.

Second, we found support for our hypotheses on the democratizing role of the internet—the gender gap–mitigating effect of the internet is stronger among the subset of the population that occupies more disadvantaged positions in society. Specifically, we found that the gender gap–mitigating effect of internet use is stronger among the lower educated and those living in regions with lower gender equality, and the effect is also stronger for transition to informal than to formal entrepreneurship. These findings are robust to various ways of measuring internet use (both as a Likert-scale frequency measure and as a dichotomous measure of having versus not having access), and they are also robust to various model specifications (fixed-effect linear probability model, random-effect logit model, and Cox proportional hazard model).

Our research makes important contributions to the theory of entrepreneurship, particularly in the area related to the persistent gender gap in entrepreneurship. Broadly, research on entrepreneurship has been relatively weak in evaluating potential tools that can remove the roadblocks and level the playing field for men and women. Particularly with regard to gender, we have accumulated deep knowledge of *why* there is a large gender gap in entrepreneurship, but not enough on *what we can do* to change it. While

smaller-scale case studies exist, ours is one of the few studies that set out to evaluate potential interventional tools. Our empirical findings suggest that ICT (the internet, in particular) may be a useful tool for promoting entrepreneurship among women and especially among women in socially and economically disadvantaged positions.

The findings in this paper therefore may serve as the basis for consideration of interventional measures by policy makers aiming to broaden participation in entrepreneurship and create more opportunities for marginalized members of society. Our study has shown that digital technologies, particularly the internet, can play a role in promoting entrepreneurship among women, especially those who are socio-economically disadvantaged. This finding has significant potential policy implications. It suggests that policy makers could invest in initiatives aimed at increasing internet access among women. By doing so, they could help to create a more level playing field and ensure that women have access to the same tools and resources as men for engaging in entrepreneurship.

Another potential policy implication of our study is related to the informal and formal aspects of entrepreneurship. We found that women are more likely to benefit from digital technologies in informal entrepreneurship than in formal entrepreneurship. This difference reflects the unique challenges that women face in accessing the formal economy, where institutional barriers can limit their ability to grow and scale their businesses. Policy makers can take this finding into account when designing interventions aimed at promoting entrepreneurship among women, by focusing more on formal entrepreneurship to promote the full benefits of ICT for women.

Indeed, some interventional field experiments have already been attempted, such as the study deployed in 10 Indian villages by Venkatesh et al. (2017). Our research has provided large-scale, data-based evidence for future policy interventions like the one in Venkatesh et al.'s (2017) field experiment. By investing in initiatives that expand access to the internet and promote digital literacy, policy makers can create a more inclusive and equitable entrepreneurship ecosystem, where women have the same opportunities to succeed as men. In addition, policy makers should consider the different needs and opportunities of informal and formal entrepreneurship, to ensure that their interventions are relevant and effective. Overall, we hope that our study will inspire policy makers to think creatively about how to promote entrepreneurship among women and contribute to closing the persistent gender gap in entrepreneurship.

Although our study contributes valuable evidence on the role of digital technologies in narrowing

the gender gap in entrepreneurship, it is important to recognize its limitations. One key limitation of our study is that it focuses only on one country and may have generalizability risks when the key takeaway from the study is applied to other contexts. We tested our hypotheses on individuals residing in China, which represents an important emerging economy. While we believe that this adds greatly to the corpus of entrepreneurship knowledge (as the bulk of entrepreneurship research featured in top-cited journals is still predominantly based on US or European data), the Chinese context of our empirical evidence may be unique. For this reason, we think that while our empirical evidence is valuable for potential policy interventions, we also wish to caution against overgeneralization of our findings. On this front, we believe that our findings would benefit greatly from replication with data from other regions and societies.

Another limitation of our study is that it is primarily based on survey data, which are subject to self-report biases and other limitations. In addition, while we have analyzed the data rigorously, we cannot rule out the possibility of omitted variable bias or other issues that could affect the accuracy of our results. As our research does not follow a random-assignment field-controlled experimental protocol, we caution against interpretation of our findings as causal. A random experiment or quasi-experimental design study would be better at testing the causal mechanisms we have discussed in our study in the future.

In addition, we note that further work is needed to extend some of the core findings of our study. We focused primarily on the internet. While the internet is a powerful ICT tool, many other forms of technological tools exist, and future research could shed light on whether they facilitate the development of female entrepreneurs. For example, new technological frontiers such as artificial intelligence and the Internet of Things have meshed ICT technologies into our everyday lives and work. These newer generations of technologies may shift the entrepreneurial opportunity structure for women; yet it is also possible that they may present more obstacles to women's participation in entrepreneurship. As such, their impact on the gender gap in entrepreneurship is unknown and future research would be needed to assess more varieties of technologies.

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TABLE 1. Variable Definition

Variable Name	Definition
Entrepreneurship	Coded as 1 if respondent reported in a year that he or she was self-employed or ran his or her own business in a non-agricultural sector and 0 otherwise
Formal entrepreneurship	Coded as 1 if respondent reported that he or she ran his or her own business in a non-agricultural sector *and* that the business provided employees with insurances, and 0 if the business provided no insurances to employees (i.e., as "informal entrepreneurship")
Woman	Coded as 1 if respondent self-identified as woman and 0 otherwise
Frequency of internet use	The mean of respondent's answer on the frequency Likert-scale regarding internet use across five different activities: study, socializing, entertainment, work and commercial activities
Use internet	Coded 1 if the respondent's answer to the question "do you use the internet or not" is "yes" in the year and 0 otherwise
Education	Number of years of schooling respondent has received
Regional gender equality	The level of gender stereotype in the province where respondent lives in the year
Age	Respondents' age in the year
Marital status	Coded as 1 if married in the year and 0 otherwise
Number of children	The total number of children respondent has in the year
Urban region	Coded as 1 if respondent lives in an urban area and 0 otherwise in the year
Political connection	Coded as 1 if respondent is a member of the Chinese Communist Party or the Communist Youth League and 0 otherwise in the year
Family deposit	Log of amount of total household deposit in financial institutions in the year
Family income	Log of total household income from all sources after taxes and other deductions were made in the year
Loan from bank	Log of amount of loans from banks (except house mortgage) remaining to be paid by the respondent's family in the year
Loan from private sources	Log of amount of family loans from relatives, friends, and organizations other than banks in the year
Financial product	Log of value of household financial products, including stocks and funds, in the year
Province population density	The number of people per square kilometer of the province where respondent lives in the year
Province GDP per capita	GDP per capita of a province where respondent lives in the year
Number of privately owned industrial enterprises in the province	Number of privately owned industrial enterprises in a province where respondent lives in the year
Province average wage	Average wage in the province where respondent lives in the year

TABLE 2. Descriptive Statistics

	Mean	S.D.	Min	Max
Number of individual-year observations = 84,004				
Entrepreneurship	0.095	0.293	0	1
Woman	0.525	0.499	0	1
Frequency of internet use	2.035	1.668	1	7
Use the internet	0.320	0.467	0	1
Education	7.701	4.775	0	23
Regional gender equality	2.634	0.168	2.055	3.75
Age	44.833	12.469	18	65
Marital status	0.854	0.353	0	1
Number of children	1.091	1.098	0	10
Political connection	0.456	0.498	0	1
Urban region	0.132	0.339	0	1
Family deposit (logged, in RMB)	6.046	4.838	0	15.761
Family income (logged, in RMB)	10.067	2.185	0	16.118
Loan from bank (logged, in RMB)	0.872	2.885	0	15.202
Loan from private sources (logged, in RMB)	3.470	4.567	0	15.425
Financial product (logged, in RMB)	0.550	2.367	0	16.118
Population density in the province (logged, ten thousand people /square kilometer)	5.724	1.034	3.047	8.256
GDP per capita in the province (logged, in RMB)	10.613	0.469	9.482	11.851
Num. of privately owned industrial enterprises in the province (logged)	8.549	1.146	6.275	10.752
Average wage in the province (logged, in RMB)	10.801	0.337	10.230	11.890

Notes: The number of observations for regional gender equality (perception) and higher regional gender equality (perception) is 82,763.

TABLE 3. Linear Probability Models of Gender and Frequency of Internet Use on Probability of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2	Model 3	Model 4	Model 5
Frequency of internet use $_{t-1}$		0.001	-0.004*		
		(0.001)	(0.001)		
Woman * Frequency of internet use $_{t-1}$			0.009**		
			(0.002)		
Use the internet or not $_{t-1}$				-0.002	-0.016**
				(0.004)	(0.006)
Woman * Use the internet or not $_{t-1}$					0.027**
					(0.007)
Education	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	0.006	0.006	0.006	0.006	0.006
	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)
Marital status	0.025**	0.025**	0.025**	0.025**	0.025**
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Num. of children	0.004**	0.004**	0.005**	0.004**	0.005**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Political connection	0.000	0.000	0.000	0.000	0.000
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Urban region $_{t-1}$	0.000	0.000	0.000	0.002	0.002
	(0.006)	(0.006)	(0.006)	(0.004)	(0.004)
Family deposit $_{t-1}$	0.002	0.002	0.002	-0.000	-0.000
	(0.004)	(0.004)	(0.004)	(0.000)	(0.000)
Family income $_{t-1}$	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Loan from bank $_{t-1}$	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Loan from private sources $_{t-1}$	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Financial product $_{t-1}$	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Population density in the province $_{t-1}$	0.005	0.005	0.003	0.005	0.003
	(0.183)	(0.183)	(0.183)	(0.076)	(0.076)
GDP per capita in the province $_{t-1}$	0.217	0.219	0.213	0.216	0.211
	(0.378)	(0.378)	(0.378)	(0.181)	(0.181)
Num. of privately owned industrial enterprises in the	-0.044	-0.045	-0.042	-0.044	-0.041
	(0.161)	(0.161)	(0.161)	(0.101)	(0.101)
Average wage in the province $_{t-1}$	-0.445	-0.447	-0.433	-0.443	-0.438
	(0.751)	(0.751)	(0.751)	(0.433)	(0.433)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes
Year * City fixed effects	Yes	Yes	Yes	Yes	Yes
Constant	2.610	2.617	2.526	2.606	2.592
	(4.949)	(4.949)	(4.949)	(3.911)	(3.914)
Observations	84,004	84,004	84,004	84,004	84,004
Number of individuals	25,177	25,177	25,177	0.018	0.018
R-squared	0.018	0.018	0.018	25,177	25,177

Notes: (1) Reports Fixed-Effect Linear Probability model estimates on probability of entrepreneurship in a given year; (2) Robust standard errors are reported; (3) ** $p<0.01$, * $p<0.05$, + $p<0.1$ (two-tailed test).

TABLE 4 Linear Probability Models of Gender, Frequency of Internet Use, and Education on Probability of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2	Model 3
Sample	All	Higher Educated	Lower Educated
Frequency of internet use $_{t-1}$	-0.014**	-0.003	-0.011*
	(0.005)	(0.002)	(0.005)
Woman * Frequency of internet use $_{t-1}$	0.026**	0.007**	0.020**
	(0.006)	(0.003)	(0.006)
Education (number of years in school)	-0.003*		
	(0.002)		
Woman * Education	0.006**		
	(0.002)		
Education * Frequency of internet use $_{t-1}$	0.001*		
	(0.000)		
Woman * Frequency of internet use$_{t-1}$ * Education	-0.002**		
	(0.001)		
Control variables (same as in Table 3) Included	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes
Year * City fixed effects	Yes	Yes	Yes
Constant	2.622	5.447	2.387
	(3.907)	(3.480)	(8.746)
Observations	84,004	48,454	35,550
Number of individuals	25,177	15,304	11,140
R-squared	0.011	0.016	0.022

Notes: (1) Reports Fixed-Effect Logit model estimates on probability of entrepreneurship in a given year; (2) (2) Robust standard errors are reported; (3) ** $p<0.01$, * $p<0.05$, + $p<0.1$ (two-tailed test).

TABLE 5. Linear Probability Models of Gender, Frequency of Internet Use, and Regional Gender Equality on Probability of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2	Model 3
Sample	All	Regional Gender Equality	
		Above median	Below median
Frequency of internet use $_{t-1}$	-0.003+	-0.002	-0.006+
	(0.002)	(0.003)	(0.003)
Woman * Frequency of internet use $_{t-1}$	0.008**	0.006+	0.012**
	(0.003)	(0.003)	(0.004)
Regional gender equality (continuous) $_{t-1}$	-0.096*		
	(0.039)		
Woman * Regional gender equality $_{t-1}$	0.090**		
	(0.029)		
Regional gender equality$_{t-1}$ * Frequency of internet use $_{t-1}$	0.015*		
	(0.007)		
Woman * Frequency of internet use$_{t-1}$ * Regional gender equality $_{t-1}$	-0.015+		
	(0.008)		
Control variables (same as in Table 3) Included	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes
Year * City fixed effects	Yes	Yes	Yes
Constant	2.749	-6.809	20.830*
	(3.904)	(25.896)	(10.303)
Observations	82,763	43,676	40,328
R-squared	0.019	0.015	0.023
Number of individuals	24,792	16,309	15,200

Notes: (1) Reports Fixed-Effect Linear Probability model estimates on probability of entrepreneurship in a given year; (2) Robust standard errors are reported; (3) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE 6. Linear Probability Models of Gender and Frequency of Internet Use on Probability of Formal vs. Informal Entrepreneurship

DV:	Model 1 Formal entrepreneurship	Model 2 Informal entrepreneurship
Frequency of internet use $_{t-1}$	0.002*	-0.005**
	(0.001)	(0.002)
Woman * Frequency of internet use $_{t-1}$	-0.001	0.010**
	(0.001)	(0.002)
Control variables (as in Table 3) Included	Yes	Yes
Individual fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Year * City fixed effects	Yes	Yes
Constant	0.119	2.434
	(0.688)	(4.031)
Observations	77,288	82,749
Number of individuals	24,623	25,150
R-squared	0.014	0.012

Notes: (1) Reports Fixed-Effect Linear Probability model estimates on probability of entrepreneurship in a given year; (2) Robust standard errors are reported; (3) ** $p<0.01$, * $p<0.05$, + $p<0.1$ (two-tailed test).

TABLE 7a. Instrumental Variable Regression of Gender and Frequency of Internet Use on Probability of Entrepreneurship with Broadband China Policy IV

DV:	Entrepreneurship (Yes=1)
Frequency of internet use $_{t-1}$	0.087+
	(0.049)
Woman * Frequency of internet use $_{t-1}$	0.034**
	(0.011)
Control variables included	Yes
Individual fixed effects	Yes
Year fixed effects	Yes
City fixed effects	Yes
Constant	0.117
	(0.613)
Observations	83,997
Number of individuals	25,177

	First Stage Results	
	Model 1	Model 2
DV:	Frequency of internet use	Woman * Frequency of internet use
Broadband China	0.081**	-0.281**
	(0.023)	(0.008)
Woman * Broadband China	-0.002	0.606**
	(0.028)	(0.019)
Control variables included	Yes	Yes
Individual fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Constant	-3.165**	-2.199**
	(3.011)	(1.540)
Observations	83,997	83,997
Number of individuals	25,177	25,177
F-Statistic	133.4	96.1

Notes: (1) Reports 2SLS model estimates on probability of entrepreneurship; Individual respondent's frequency of internet use variable is instrumented by Broadband China policy; (3) Robust standard errors are given in parentheses; (4) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE 7b. Instrumental Variable Regression of Gender and Frequency of Internet Use on Probability of Entrepreneurship with local rate of Internet use IV

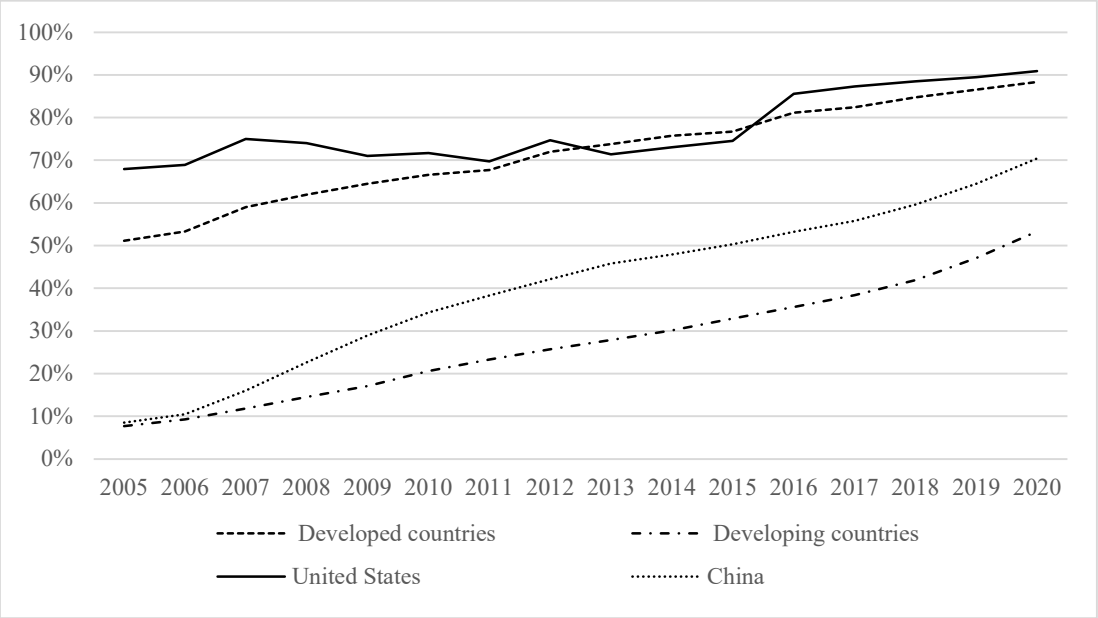
DV:	Entrepreneurship (Yes=1)
Frequency of internet use $_{t-1}$	-0.025**
	(0.007)
Woman * Frequency of internet use $_{t-1}$	0.033**
	(0.004)
Control variables included	Yes
Individual fixed effects	Yes
Year fixed effects	Yes
City fixed effects	Yes
Constant	-0.428
	(0.472)
Observations	84,004
Number of individuals	25,177

First Stage Results

	Model 1	Model 2
DV:	Frequency of Internet use	Woman * Frequency of Internet use
Local (city-level) internet use rate	0.744**	0.012
	(0.020)	(0.014)
Woman * Local (city-level) internet use	0.008	0.722**
	(0.013)	(0.009)
Control variables included	Yes	Yes
Individual fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Constant	-1.841**	-2.199**
	(1.874)	(1.540)
Observations	84,004	84,004
Number of individuals	25,177	25,177
F-Statistic	115.43	119.59

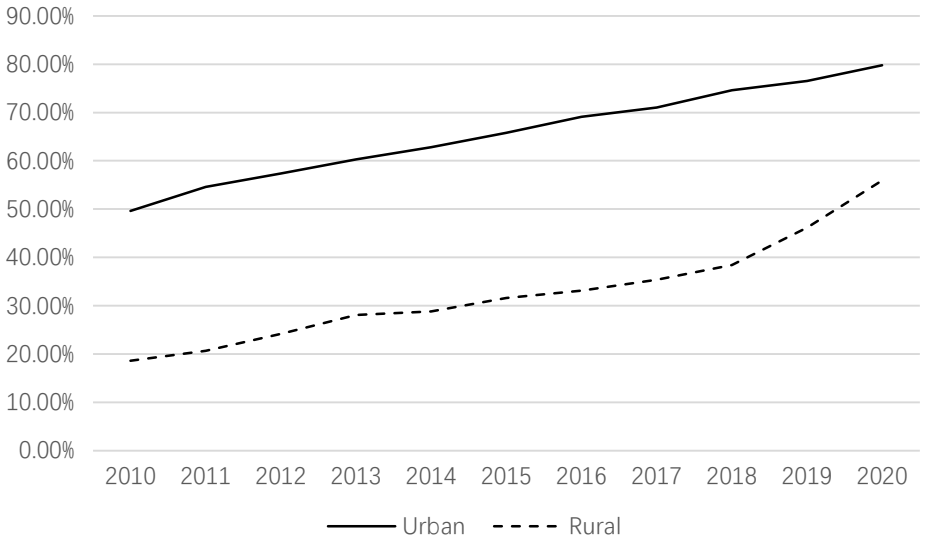
Notes: (1) Reports 2SLS model estimates on probability of entrepreneurship; Individual respondent's frequency of internet use variable is instrumented by the internet use aggregated at the city level; (3) Robust standard errors are given in parentheses; (4) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

FIGURE 1. Proportion of Population Using Internet



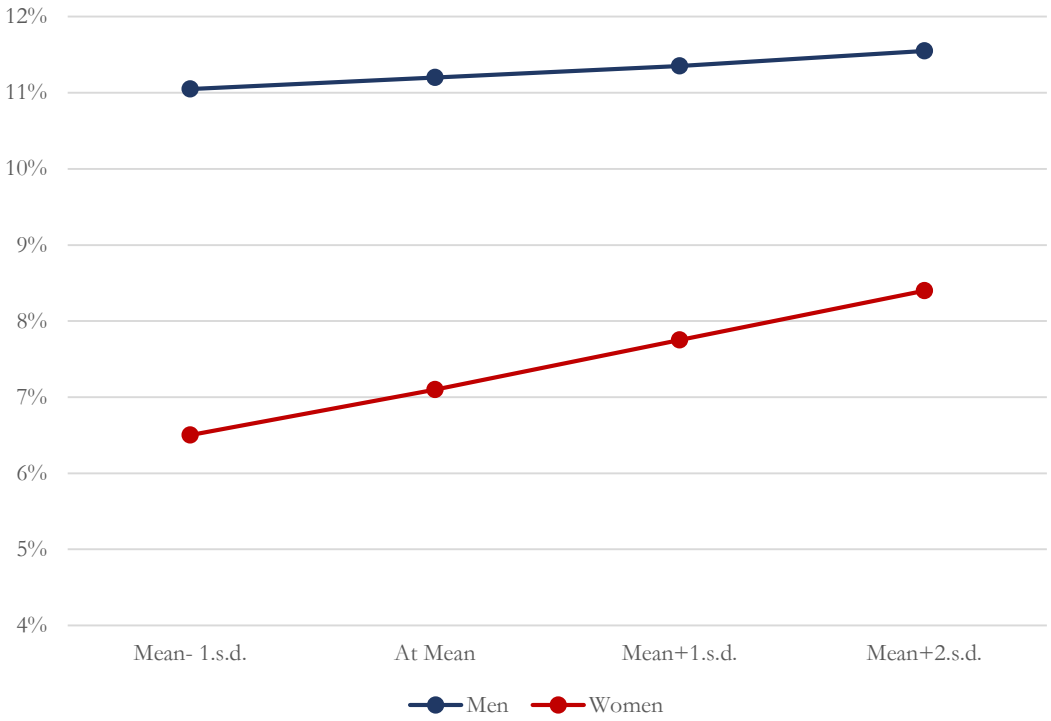
Notes: (1) Figure reports the proportion of residents in China, U.S., developed countries and developing countries who have access to the internet through mobile phone, computer, and other devices based on *The International Telecommunication Union (ITU)* official website; (2) The classification of developed and developing countries is based on the M49 classification standard, which is developed and used by the United Nations for statistical purposes.

FIGURE 2. Proportion of Rural and Urban Residents Using the Internet in China



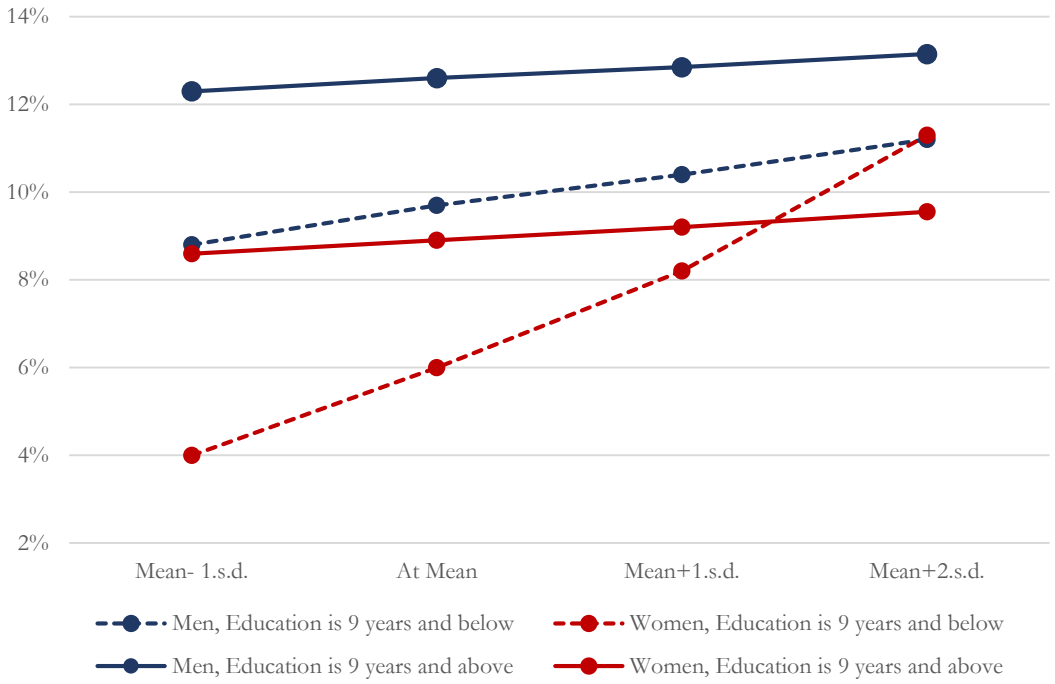
Notes: Figure reports the proportion of urban and rural residents in China with access to the internet through mobile phone, computer, and other devices based on *China Statistical Report on Internet Development*.

FIGURE 3. Frequency of Internet Use and the Predicted Probability of Entrepreneurship, Broken Out by Gender



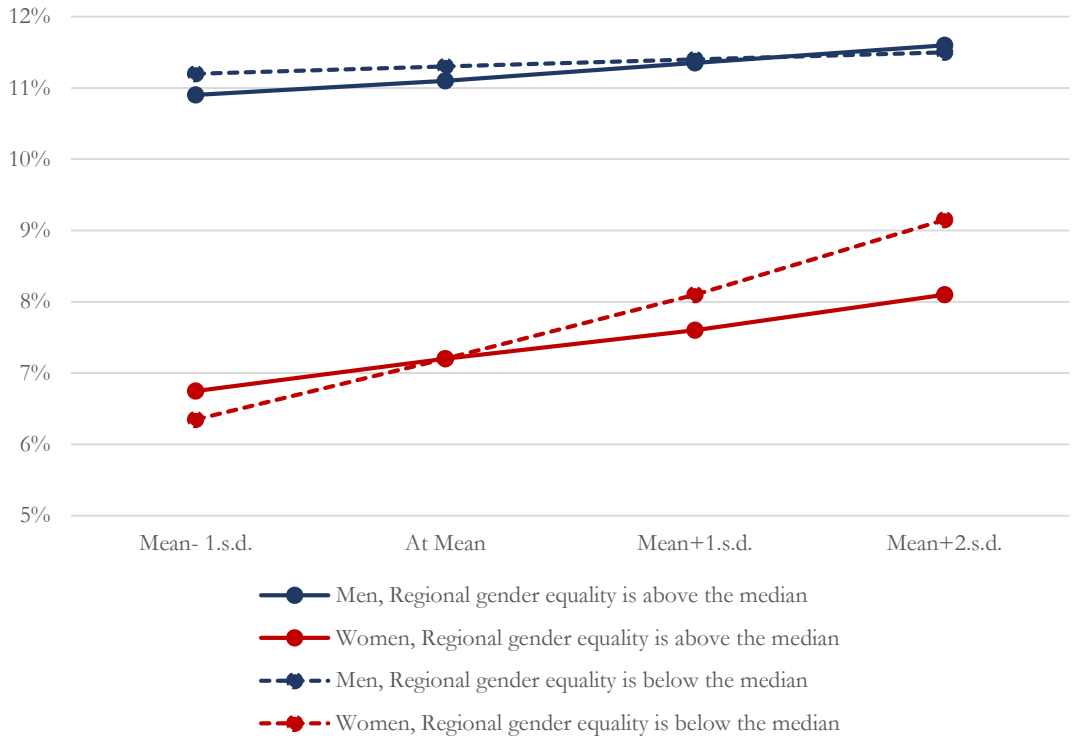
Notes: Presents the association of frequency of internet use and the predicted probability of entrepreneurship, separately for women (red) and men (blue). The estimates are reported in model 2 in Table a2.

FIGURE 4. Frequency of Internet Use and the Predicted Probability of Entrepreneurship for Men and Women, Broken Out by Education



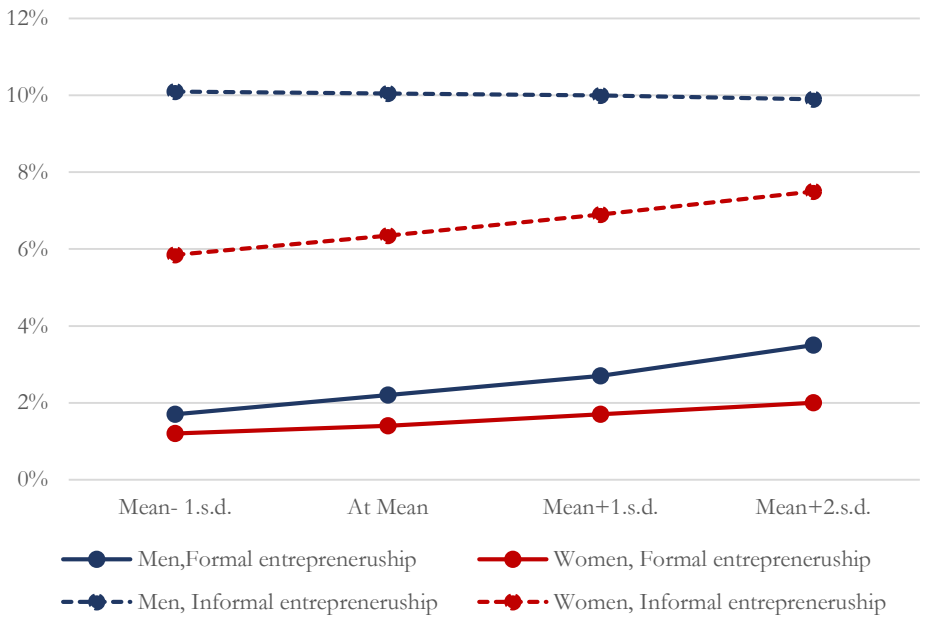
Notes: Presents the association between frequency of internet use and the predicted probability of entrepreneurship, separately for women (red) and men (blue), and broken out by education level, above nine years of schooling versus below.

FIGURE 5. Frequency of Internet Use and the Probability of Entrepreneurship for Men and Women, Broken Out by Regional Gender Equality



Notes: Presents the association between frequency of internet use and the predicted probability of entrepreneurship, separately for women (red) and men (blue), and broken out by level of regional gender equality, above-median (solid line) versus below-median level (dashed line).

FIGURE 6. Frequency of Internet Use and the Predicted Probability of Entrepreneurship for Men and Women, Broken Out by Formal versus Informal Entrepreneurship



Notes: Presents the association between frequency of internet use and the predicted probability of informal entrepreneurship (dashed lines) and formal entrepreneurship (solid lines), separately for women (red) and men (blue). The estimates are reported in models 1 and 2 in Table 6.

APPENDIX

TABLE A1 Variable Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	Entrepreneurship	1								
(2)	Formal entrepreneurship	-	1							
(3)	Female	-0.061	-0.026	1						
(4)	Frequency of the internet use	0.073	0.076	-0.045	1					
(5)	Use the internet or not	0.078	0.069	-0.059	0.868	1				
(6)	Education	0.069	0.051	-0.152	0.545	0.503	1			
(7)	Regional gender equality	-0.009	0.043	-0.001	0.253	0.226	0.201	1		
(8)	Age	-0.056	-0.014	-0.014	-0.490	-0.465	-0.388	-0.019	1	
(9)	Marital status	0.063	0.027	0.039	-0.242	-0.206	-0.179	-0.054	0.341	1
(10)	Num. of children	-0.009	-0.050	0.032	-0.399	-0.418	-0.319	-0.272	0.324	0.267
(11)	Political connection	0.094	0.068	0.013	0.242	0.226	0.305	0.178	-0.025	-0.037
(12)	Urban region	-0.014	-0.002	-0.070	0.258	0.223	0.323	0.044	-0.245	-0.255
(13)	Family deposit	0.048	0.059	-0.005	0.189	0.176	0.196	0.141	-0.010	0.015
(14)	Family income	0.036	0.048	-0.006	0.228	0.228	0.215	0.154	-0.031	0.024
(15)	Loan from bank	0.039	0.023	-0.008	0.041	0.032	0.005	0.036	-0.053	0.001
(16)	Loan from private sources	0.013	0.020	-0.001	0.027	0.055	-0.023	-0.123	-0.029	-0.008
(17)	Financial product	0.004	0.038	0.001	0.217	0.191	0.219	0.168	-0.001	-0.008
(18)	Population density in the province	0.038	0.018	0.002	0.151	0.132	0.194	0.031	0.028	0.001
(19)	GDP per capita in the province	0.031	0.040	0.002	0.253	0.255	0.240	0.126	0.064	-0.026
(20)	Num. of privately owned industrial enterprises in the province	0.065	0.024	0.013	0.045	0.039	0.095	-0.141	0.015	0.016
(21)	Average wage in the province	0.006	0.046	-0.010	0.306	0.317	0.185	0.349	0.058	-0.043

		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(10)	Num. of children	1										
(11)	Political connection	-0.165	1									
(12)	Urban region	-0.133	0.085	1								
(13)	Family deposit	-0.178	0.173	0.036	1							
(14)	Family income	-0.198	0.157	0.059	0.240	1						
(15)	Loan from bank	-0.008	-0.071	0.018	-0.088	-0.006	1					
(16)	Loan from private sources	-0.173	-0.058	-0.021	-0.106	0.049	0.085	1				
(17)	Financial product	-0.092	0.214	0.068	0.184	0.130	-0.010	-0.048	1			
(18)	Population density in the province	-0.062	0.254	0.030	0.172	0.143	-0.123	-0.057	0.226	1		
(19)	GDP per capita in the province	-0.285	0.267	0.031	0.247	0.284	-0.111	0.013	0.202	0.721	1	
(20)	Num. of privately owned industrial enterprises in the province	-0.003	0.174	0.010	0.078	0.041	-0.117	-0.034	0.028	0.650	0.482	1
(21)	Average wage in the province	-0.417	0.174	0.023	0.243	0.364	-0.034	0.113	0.182	0.413	0.767	0.029

Tables A2 to A6 replicate Tables 3 to 6 in the main text with random effect estimations.

TABLE A2. Replicating Table 3 in Main Text with Random Effect Estimations Logit Models of Gender and Internet Use on Probability of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2
Female	-0.942**	-1.148**
	(0.066)	(0.095)
Frequency of internet use $_{t-1}$	0.064**	0.026
	(0.019)	(0.024)
Woman * Frequency of internet use $_{t-1}$		0.089**
		(0.029)
Year fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Year * City fixed effects	Yes	Yes
Constant	-55.941	-54.799
	(73.327)	(73.129)
Observations	83,852	83,852
Number of individuals	25,176	25,176

Notes: (1) Reports random-Effect logit model estimates on probability of entrepreneurship in a given year; (2) Robust standard errors are reported; (3) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE A3. Replicating Table 4 (Models 3 and 4) in Main Text with Random Effect Estimations

Logit Models of Gender, Internet Use, and Education on Probability of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2	Model 3
Sample	All	Higher Educated	Lower Educated
Female	-1.039**	-0.679**	-1.457**
	(0.099)	(0.120)	(0.153)
Frequency of internet use $_{t-1}$	0.508**	0.060*	0.011
	(0.066)	(0.026)	(0.059)
Woman * Frequency of internet use $_{t-1}$	0.318**	0.008	0.277**
	(0.091)	(0.033)	(0.080)
Education (number of years in school)	0.087**		
	(0.016)		
Woman * Education	0.098**		
	(0.022)		
Education * Frequency of internet use $_{t-1}$	-0.043**		
	(0.006)		
Woman * Frequency of internet use$_{t-1}$ * Education	-0.026**		
	(0.008)		
Control variables (same as in Table 3) Included	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes
Year * City fixed effects	Yes	Yes	Yes
Constant	-60.640	3.054	-6.809
	(73.114)	(11.398)	(17.638)
Observations	83,852	48,447	35,489
Number of individuals	25,176	15,304	11,118

Notes: (1) Reports Random-Effect Logit model estimates on probability of entrepreneurship in a given year; (2) Robust standard errors are reported; (3) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE A4. Replicating Table 5 in Main Text with Random Effect Estimations

Logit Models of Gender, Frequency of Internet Use, and Regional Gender Equality on Probability of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2	Model 3
Sample	All	Regional Gender Equality	
		Above median	Below median
Female	-1.045**	-0.994**	-1.099**
	(0.096)	(0.132)	(0.126)
Frequency of internet use $_{t-1}$	0.028	0.053+	0.012
	(0.024)	(0.031)	(0.034)
Woman * Frequency of internet use $_{t-1}$	0.068*	0.029	0.109**
	(0.030)	(0.038)	(0.042)
Regional gender equality (continuous) $_{t-1}$	0.027		
	(0.458)		
Woman * Regional gender equality $_{t-1}$	1.624**		
	(0.475)		
Regional gender equality$_{t-1}$ * Frequency of internet use $_{t-1}$	0.100		
	(0.096)		
Woman * Frequency of internet use$_{t-1}$ * Regional gender equality $_{t-1}$	-0.289*		
	(0.136)		
Control variables (same as in Table 3) Included	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes
Year * City fixed effects	Yes	Yes	Yes
Constant	-1.269	3.928	-6.221
	(10.242)	(13.227)	(20.495)
Observations	82,756	42,526	41,428
Number of individuals	24,792	14,607	14,088

Notes: (1) Reports random-Effect logit model estimates on probability of entrepreneurship in a given year; (2) Robust standard errors are reported; (3) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE A5. Replicating Table 6 in Main Text with Random Effect Estimations

Logit Models of Gender and Frequency of Internet Use on Probability of Informal versus Formal Entrepreneurship

	Model 1	Model 2
DV:	Formal entrepreneurship	Informal entrepreneurship
Female	-0.451**	-1.107**
	(0.163)	(0.095)
Frequency of internet use $_{t-1}$	0.223**	-0.008
	(0.043)	(0.024)
Woman * Frequency of internet use $_{t-1}$	-0.077	0.100**
	(0.048)	(0.030)
Control variables (as in Table 3) Included	Yes	Yes
Year fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Year * City fixed effects	Yes	Yes
Constant	0.212	-0.881
	(17.393)	(10.382)
Observations	75,996	82,742
R-squared	24,051	25,150

Notes: (1) Reports Random-Effect logit model estimates on probability of entrepreneurship in a given year; (2) Robust standard errors are reported; (3) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE A6. Multinomial Logit Models of Gender and Frequency of Internet Use on Probability of Formal vs. Informal Entrepreneurship

	Model 1	Model 2
DV:	Formal entrepreneurship	Informal entrepreneurship
Female	-0.312**	-0.542**
	(0.105)	(0.044)
Frequency of internet use $_{t-1}$	0.172**	0.019
	(0.027)	(0.013)
Woman * Frequency of internet use $_{t-1}$	-0.050+	0.025+
	(0.029)	(0.015)
Control variables (as in Table 3) Included	Yes	Yes
Year fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Year * City fixed effects	Yes	Yes
Constant	-0.412	-0.299
	(12.519)	(6.937)
Observations	84,004	84,004

Notes: (1) Reports Random-Effect multinomial logit model estimates of probability of entrepreneurship in a given year; base category are respondents who did not self-report as self-employed or working for own ventures. (2) Robust standard errors are reported; (3) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

Tables A7 to A10 replicate Tables 3 to 6 in the main text with the Cox proportional-hazards model of the transition to entrepreneurship.

TABLE A7. Cox Model of Gender and Internet Use on Hazard of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2
Women	-0.516**	-0.638**
	(0.032)	(0.052)
Frequency of internet use $_{t-1}$	0.016	-0.006
	(0.013)	(0.015)
Woman * Frequency of internet use $_{t-1}$		0.055**
		(0.018)
Year fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Year * City fixed effects	Yes	Yes
Observations	76,229	76,229

Notes: (1) Reports cox model estimates on probability of entrepreneurship in a given year; (2) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE A8. Cox Models of Gender, Frequency of Internet Use, and Education on Hazard of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2	Model 3
Sample	All	Higher Educated	Lower Educated
Female	-0.573**	-0.416**	-0.806**
	(0.058)	(0.067)	(0.094)
Frequency of internet use $_{t-1}$	0.108**	0.028+	0.030
	(0.018)	(0.016)	(0.038)
Woman * Frequency of internet use $_{t-1}$	0.050+	0.011	0.127*
	(0.026)	(0.021)	(0.056)
Education (number of years in school)	-0.001		
	(0.006)		
Woman * Education	0.025**		
	(0.009)		
Education * Frequency of internet use $_{t-1}$	-0.032**		
	(0.004)		
Woman * Frequency of internet use$_{t-1}$ * Education	-0.009+		
	(0.005)		
Control variables (same as in Table 3) Included	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes
Year * City fixed effects	Yes	Yes	Yes
Observations	66,642	42,952	33,277

Notes: (1) Reports cox model estimates on probability of entrepreneurship in a given year; (2) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE A9. Cox Models of Gender, Frequency of Internet Use, and Regional Gender Equality (Stereotype) on Hazard of Entrepreneurship

DV: *Entrepreneurship (Yes=1)*	Model 1	Model 2	Model 3
Sample	All	Regional Gender Equality	
		Above median	Below median
Female	-0.600**	-0.739**	-0.552**
	(0.057)	(0.074)	(0.078)
Frequency of internet use $_{t-1}$	-0.010	-0.030	0.007
	(0.016)	(0.022)	(0.021)
Woman * Frequency of internet use $_{t-1}$	0.052**	0.108**	0.019
	(0.020)	(0.029)	(0.026)
Regional gender equality (continuous) $_{t-1}$	0.281		
	(0.412)		
Woman * Regional gender equality $_{t-1}$	0.866*		
	(0.338)		
Regional gender equality$_{t-1}$ * Frequency of internet use $_{t-1}$	0.043		
	(0.082)		
Woman * Frequency of internet use$_{t-1}$ * Regional gender equality $_{t-1}$	-0.265*		
	(0.115)		
Control variables (same as in Table 3) Included	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes
Year * City fixed effects	Yes	Yes	Yes
Observations	75,693	39,046	37,760

Notes: (1) Reports cox model estimates on probability of entrepreneurship in a given year; (2) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE A10. Cox Models of Gender and Frequency of Internet Use on Hazard of Informal versus Formal Entrepreneurship

DV:	Model 1 Formal entrepreneurship	Model 2 Informal entrepreneurship
Female	-0.316**	-0.629**
	(0.111)	(0.054)
Frequency of internet use $_{t-1}$	0.142**	-0.014
	(0.027)	(0.015)
Woman * Frequency of internet use $_{t-1}$	-0.033	0.056**
	(0.032)	(0.019)
Control variables (as in Table 3) Included	Yes	Yes
Year fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Year * City fixed effects	Yes	Yes
Observations	82,781	76,806

Notes: (1) Reports cox model estimates on probability of entrepreneurship in a given year; (2) ** p<0.01, * p<0.05, + p<0.1 (two-tailed test).

TABLE A11a. Data Construction Process

Step	Process	Sample size
1	Raw data (6 waves)	204,617 person-year observations for 57,613 individuals
2	Retaining individuals who are between 18 and 65 years old	171,350 person-year observations for 48,922 individuals
3	Restricting our sample to individuals who have appeared in at least two consecutive waves	131,038 person-year observations for 26,021 individuals
4	Eliminating observations with missing values	84,004 person-year observations for 25,177 individuals

TABLE A11b. Final sample

Note. Due to variable lagging requirement in our models, observations in 2010 were dropped.

Year	Observations
2012	19,568
2014	17,611
2016	18,174
2018	17,154
2020	11,497