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Digital Financial Capability and Household Entrepreneurial Performance^{*}

By Luo Yu, Peng Yuchao and Zeng Lianyun^{*}

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Abstract

In the context of fast digitization of commercial and financial ecosystem in China, this study explores the impact of digital financial capability on household entrepreneurial performance. Utilizing China Household Finance Survey 2017 data, this paper is among the first to define and measure digital financial capability, showing that it has significant and positive influence on household business ownership, innovation and financial performance. The results still hold after addressing endogeneity. Furthermore, we illustrate how digital financial capability impacts household entrepreneurial performance by scrutinizing indirect effects of both commercial and financial channels. In addition, heterogeneity regarding vulnerable populations is also examined for deepening understanding of such relationships. This study calls attention to the importance of digital financial capability to better look upon the opportunities and challenges in real-time micro economic lives in China and beyond, providing insights on whether and how digital financial capability affects household entrepreneurial performance, as well as implications for emerging economics who are going through similar developing stages.

Keywords: digital financial capability; household entrepreneurial performance; business ownership; business innovation; business financial performance

JEL classification codes: L26, L96, G53

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1. Introduction

With the fast penetration of digital technology into economic lives, financial services have not only gone through an unprecedented digitization process, but also interacted with more and more daily commercial scenarios, which keep bringing new chances for inclusive growth (Manyika et al., 2016; Siddik and Kabiraj, 2020; Zetsche, Buckley, and Arner, 2019). In China, the tremendous volume of digital transactions has been eye-catching, imposing disruptive changes to the commercial ecosystem. As a result, the ability to cope with those changes has been steadily becoming crucial for potential and existing business owners. Such situation stood out during the COVID-2019 pandemic, where online businesses better survived and served households during the sudden and strict quarantines.

However, not all populations are prepared for the benefit and upcoming opportunities. Only with adaptive capability can people make full use of the products and services that have the potential to change lives. Otherwise, they may well be relatively deprived and left behind. Therefore, we need to pay attention to the opportunities and gaps in the digital era from a micro level, and explore the economic changes that capability building can bring to the underrepresented.

It is worth noting that, with continuous development and application of financial technologies, we seem to have come to a stage where it is difficult to separate digital technologies with people's everyday financial activities. Latest international meetings, like T20 in Japan and 2019 ADBI annual conference, have already signaled global concerns on the inseparability of digital technologies from financial services, and raised it to the considerations of future education, work, and SME policies. As a result, the concept of digital financial literacy was brought up by the think tank (Morgan, Huang and Trinh, 2019), which generally refers to knowledge of using digital financial services, including, what the digital financial products or services are available, what the risks are, how to control such risks, as well as how to settle consumer disputes.

It is no doubt a timely breakthrough to modify traditional concept of financial literacy, so as to take into account prominent changes in the digital age (Lyons et al., 2020). Nevertheless, as argued by Atkinson, McKay, Collard and Kempson (2007) and Johnson and Sherraden (2007), financial literacy might not work well if people just know about it, but do not actually realize financial behaviors. Thus, based on the concept of financial capability, which also puts emphasis on realization of behaviors, we propose to define the concept of digital financial capability and look at its impact on household entrepreneurial activities.

Using the China Household Finance Survey 2017 data, this paper specifically studies the impact of digital financial capability on household entrepreneurial performance. We make three important contributions to the existing literature. First, this paper is among the first to draw attention to the emergence of digital financial capability as an important component of human capital in the digital era, and define it explicitly. Second, we provide detailed discussions on whether and how digital financial capability impacts household entrepreneurial performance, by dealing with endogeneity and examining both commercial and financial mediation channels through which digital financial capability makes differences. The dependent variables used to depict household entrepreneurial performance are multidimensional, including, business ownership, business innovation and financial performance, which help create a good picture of the role digital financial capability plays in households' entrepreneurial decision making and performance. Last but not the least, we illustrate the heterogeneity of impacts by different

populations, so as to provide policy implications for vulnerable groups, as well as experience for economies who are going through similar stages.

The remainder of this paper is as follows. The second section reviews the literature and demonstrates how we extend existing literature, which is followed by a section introducing the data and variables. The fourth and fifth sections present our methodology and results respectively. The final section includes conclusions and discussion.

2. Literature review and background

To illustrate how we complement the existing studies, we review the literature from three perspectives, namely, financial capability and household entrepreneurial performance, digitization and household entrepreneurial performance, as well as the rising importance of digital financial capability.

2.1 Financial capability and household entrepreneurial performance

Financial capability adds to financial literacy with emphasis on attitudes and behaviors, shedding light on the actual interaction between financial consumers and the financial sector (Johnson and Sherraden, 2007). Since there is very limited comprehensive evidence on how financial capability impacts household entrepreneurial performance, it is necessary to explore the literature on how those different dimensions of financial capability impacts household entrepreneurial activities.

Financial knowledge & skills have significant and positive impact on households' entrepreneurial decisions (Ćumurović, and Hyll, 2019; Yin, Song, Wu, and Peng, 2015). The argument is that, with proper financial knowledge & skill, households would make better use of borrowing opportunities, their risk tolerance would change, their demand for and accessibility to formal credit would increase, which help make their entrepreneurial decisions into being. Besides, evidence is also found around the association between financial knowledge & skills of entrepreneurs and financial performance (Kojo Oseifuah, 2010). However, specific discussion on the impact of financial knowledge & skills on business innovation is scarce, which we surmise to be a neglected booster of business performance.

While few studies explore the relationship between financial attitudes and household entrepreneurship, we suppose there might be indirect association through financial behaviors, as evidence is shown by Atkinson and Messy (2012) that there is positive correlation between financial attitudes and behaviors.

When it comes to financial behaviors, the key argument is whether they help mitigate liquidity or credit constraint, while there are also function channels concerning confidence and behavioral preferences (Aghion, Fally, and Scarpetta, 2007; Blanchflower and Oswald, 1998; Evans and Jovanovic, 1989; Kerr and Nanda, 2009). We review findings around usage of loans, credit card, savings, insurance and other diversified investment behaviors as follows.

With respect to loans, opinions are divided on the impacts of different loan sources. While quite a few studies demonstrate positive impact of bank loan usage on business performance and innovation (Ayyagari, Demirgüç-Kunt, and Maksimovic, 2010, 2011; Demirgüç-Kunt, Klapper, and Panos, 2011; Hernández-Trillo, Pagán, and Paxton, 2005; Luo and Zeng, 2020), Beck, Lu and Yang (2015) indicates no significant relationship between formal loans and firm growth, but rather, confirms positive association between the use of informal loan and growth of microenterprises. Apart from that, examination around the impact of bank loan holding on household entrepreneurial decisions is still limited.

With respect to credit card usage, evidence shows that, extension of credit cards promoted business entries (Chatterji and Seamans, 2012). Consumer credit of entrepreneurs is also critical throughout stages of business development (Herkenhoff, Phillips, and Cohen-Cole, 2016). As a matter of fact, many studies point out the role of entrepreneur's personal credit as important supplement of business liquidity (Cole and Wolken, 1995). Shown by Luo and Zeng (2020), credit card usage also has positive association with business innovation.

With respect to savings, entrepreneurial households are found to have higher saving rates, so as to avoid external funding costs (Cagetti and De Nardi, 2006; Gentry and Hubbard, 2004; Quadrini, 2000). However, savings may play a less important role in business innovation (Luo and Zeng, 2020) and the impact of savings on business financial performance is not rigorously answered yet.

As for insurance and other financial investment behaviors, evidence is found on insurance's role in providing risk floor for potential entrepreneurs (Ilmakunnas and Kanninen, 2001; Luo and Zeng, 2020; Olds, 2016; Wellington, 2001), enabling them to be confident in starting their own businesses. Comparatively, studies demonstrate similar characteristic of portfolios held by entrepreneurial households that is short of diversification (Gentry and Hubbard, 2004), while Luo and Zeng (2020) further shows the negative association between diversified investment and household entrepreneurial decisions. Except that, empirical examination on the association between investment behaviors and business financial performance is still in need.

In general, there have been affluent literature regarding impacts of different dimensions of financial capability on household entrepreneurial performance, though comprehensive studies are scarce, especially those regarding business financial performance, which can be critical for survival of microenterprises, like most of those in this study. Thanks to the scattered but abundant existing findings, we are able to identify useful directions for our analysis of function channels.

2.2 Digitization and household entrepreneurial performance

Over the past decade, digitization in China and other emerging economies has been embedded with *smart* characteristics. Together with digital payment, e-commerce and social media have been penetrating deeply into micro economic lives and vastly changing household entrepreneurial activities (Chen, 2016; Luohan academy, 2019). While there has been literature on the digital transformation of enterprises from perspective of management, rigorous evidence is limited on how digitization has hatched and promoted micro or individual businesses.

Digital payment is no doubt the stepstone for creation of business models (Bansal et al, 2018), on the ground of which came into being many other digital financial services, like digital credit and digital investment. Evidence shows that digital payment has significant and positive impact on different stages of entrepreneurship, from business entry, innovation to financial performance (Dalla Pellegrina, Frazzoni, Rotondi, and Vezzulli, 2017; Sekabira and Qaim, 2017; Yin, Gong, and Guo, 2019). However, little research examines what the function channels are, and how digital payment interacts with e-commerce and social media. Besides, how other digital financial services impact household entrepreneurial performance is still a nascent area.

E-commerce and social media have been impressively reshaping how the business world operates (Aral, Dellarocas, and Godes, 2013). With the rise of social commerce, it is now even hard to talk about one of them and leave the other alone. While observations have been made around the association between e-commerce/ social media and household entrepreneurial

activities (Kapron and Meertens, 2017), there is still the need of empirical evidence on how they impact entrepreneurial performance in different stages.

In general, we can contribute to the existing literature by rigorously examining the relationships among e-commerce, social media and digital finance in household entrepreneurship, and provide policy implications not only for encouraging mass entrepreneurship and innovation, but also for optimizing financial performance and promoting survival of microenterprises.

2.3 The rising importance of digital financial capability

Under the background of ‘gig’ economy, where more and more people are becoming independent workers and getting used to temporary contracts, individuals have to be more responsible for their own lifelong finances. What is happening at the same time is the overwhelming trend of digitization of financial services, which means the need for financial consumers to be digitally sophisticated will keep growing, otherwise they may encounter problems ranging from accessibility of financial services, to fraud precaution (Morgan, Huang and Trinh, 2019). Thus, it is time to be aware about the different requirement of being financially capable in the digital age, and look seriously at the rising importance of digital financial capability.

In fact, there has already been scholarly insights related to digital financial capability, which may not be literally explicit, but the concerns have been clear. For example, OECD (2017) emphasizes the critical role of financial literacy to allow consumers and small businesses to make good use of increasingly digitized financial landscape. Lyons et al. (2020) shows the significant impact of both digital literacy and financial literacy on financial inclusion, and brings out the need to redefine traditional financial literacy to include digital literacy. To our knowledge, Morgan, Huang and Trinh (2019) was the first to mention the definition of digital financial literacy, and proposed four dimensions, namely, knowledge of digital financial products and services, awareness of digital financial risks, knowledge of digital financial risk control, and knowledge of consumer rights and redress procedures. From the structure of the definition, we can see Morgan, Huang and Trinh (2019) addresses the knowledge of key processes of using digital financial services, not covering relevant behaviors. Till now, there is scarcely any literature on the definition of digital financial capability.

In summary, previous to the definition of digital financial capability, impacts of some factors constituting financial capability on household entrepreneurial performance have been found. However, detailed examinations on whether and how those factors influence household entrepreneurial performance are still in need. In addition, while there have been observations on the changes that digitization has brought about, rigorous research on key relationships around household entrepreneurial activities is till now very limited. Furthermore, studies around the emergence and importance of digital financial capability in micro economic lives and business world have up to now been absent. Based on literature review above, we illustrate critical gaps in the domain, and key contributions we can make. Firstly, this paper is among the first to bring attention to the emergence of digital financial capability, and define it explicitly. Secondly, we provide detailed discussions on whether and how digital financial capability impacts household entrepreneurial performance, by employing instrumental variable and examining mediation channels through which digital financial capability makes changes. The dependent variables used to depict household entrepreneurial performance are multidimensional, including, business ownership, business innovation and financial performance, which can help provide a good

picture of household businesses. Last but not the least, we demonstrate the heterogeneity of impacts across different populations, so as to explore policy implications for vulnerable groups.

3. Data and variables

The data we make use of in this study are from the 2017 China Household Finance Survey (CHFS), which collected micro-level information on broad dimensions of household balance and economic activities (Gan, Yin, Jia, Xu, and Ma, 2013), covering 29 provinces and 40011 households. In comparison with the previous 3 versions of questionnaires, the fourth wave carried out in 2017 asked more about households' digital financial behaviors, which gives us the opportunity to investigate how digital financial capability influences household entrepreneurial performance. After clearing the data and dropping observations which missed key variables, we kept 38506 households as the entire sample, and 4973 households as the business sample, who were running businesses when surveyed. Variables are defined as follows.

3.1 Household entrepreneurial performance

This paper distinguishes itself from most studies focused on micro-small-medium enterprises (MSMEs) in that, it starts from the standpoint of households, and utilizes a sample large enough to describe actual situation in China, regarding how households made entrepreneurial decisions and how their businesses innovated and financially performed. On the ground of 2017 CHFS questionnaire, we were able to screen out four dependent variables in three dimensions to represent the performance of household entrepreneurial activities.

Business ownership

Regarding *Business ownership*, households were asked, "Is your family engaged in production and operation of industry and commerce, including individual business, leasing, transportation, online stores, and enterprises?" Based on the question, we code respondents' "Yes/ no" answers as a dichotomous variable made up of "1/0".

Business innovation

Regarding *Business innovation*, households were asked, "Compared with the situation of last year/first half of this year¹, are there any innovative activities concerned with products, technology, arrangement, culture, marketing, service, etc. such as R&D, new ideas, new methods, etc.?" We also code a dichotomous variable for the question.

Business financial performance

Regarding business financial performance, two dependent variables are utilized, including, *Business income*, and *Business profit*. For *Business income*, households were asked, "How much was the operating revenue of the project last year/first half of this year?" For *Business profit*, households were asked, "How much was the project gain/loss last year/for the first half of this year?" Natural logarithms were taken of the two monetary values in models for computation².

3.2 Digital financial capability

Based on the definition of financial capability provided by Atkinson, McKay, Collard, and Kempson (2007) and Perotti, Zottel, Iarossi, and Bolaji-Adio (2013), we define *Digital financial*

¹ Households were asked about the business situation of first half of this year if their businesses started from the year when surveyed.

² Concerning negative profit, we first reverse the sign of the profit to obtain natural logarithm, and then reverse the obtained value again to measure the loss.

capability (DFC) as, the ability of individuals or households to make full and reasonable use of digital financial products and services, concerning whether to make full use of the digital financial products and services that are beneficial to them, whether to properly deal with the digital financial risks, whether to reasonably safeguard their own rights and interests, and finally to fulfill informed household financial decisions.

Specifically, the independent variable, *DFC*, is measured by a multidimensional score. We decide each componential variable to be included by whether it incorporates both digital and financial elements. Overall, there are 6 componential variables that can be used, namely, household usage of self-service banking, online/mobile banking, computer payment, mobile payment, online financial investment, as well as credit card³. We generate dichotomous componential variables regarding whether respondents reported their families using those services, and then sum them up as the *DFC* score, which ranges from 0 to 6. As shown by the factor analysis adopting iterated principal-factor method in Table 1, only the first factor has eigenvalue greater than 1. The percentage of variability explained by factor 1 is 91.35%, accounting for most of the total variability, and the Kaiser-Meyer-Olkin test (Kaiser, 1974) shows the KMO index is 0.8537.

Table 1. Factor analysis for *Digital financial capability*

Factor	Eigenvalue	Cumulative	Componential variables	Factor1 loadings	KMO
Factor1	2.5587	0.9135	<i>Self-service banking</i>	0.6260	0.8665
Factor2	0.1469	0.9659	<i>Online/mobile banking</i>	0.8057	0.8152
Factor3	0.0630	0.9884	<i>Computer payment</i>	0.5498	0.8946
Factor4	0.0190	0.9952	<i>Mobile payment</i>	0.7975	0.8211
Factor5	0.0137	1.0001	<i>Online financial investment</i>	0.5034	0.8978
Factor6	-0.0002	1.0000	<i>Credit card</i>	0.5710	0.8989
	N=38,506		Overall		0.8537

3.3 Other variables

Benefiting from existing studies, we utilize two comprehensive sets of control variables respectively for both the business ownership model (The entire sample) and the business innovation and financial performance models (The business sample), shown by Table 2. According to Krasniqi (2009), determinants impacting household entrepreneurial activities include age, gender, marital status, education, family size, rural/urban residence, credit constraint, as well as industries and regions. Astebro, Herz, Nanda and Weber (2014) and Hvide and Panos (2014) also point out the impact of risk preference on entrepreneurial decisions. What's more, Yin, Gong, and Guo (2019) takes into consideration children, elders, health condition, as well as household asset. For the business sample, we add in variables capturing business characteristics, namely, business history in years, business motivations, online business models, whether the business cooperated with governments or received policy benefits, what their business forms are, natural logarithm of initial business investment, as well as industry dummies. Besides, both sets of control variables include numbers of entrepreneurial households in the community, and province dummies.

³ We tried to utilize a componential variable representing usage of digital credit services. While variables around online credit services were not available, we chose usage of credit card instead, which in fact was an early format of digital credit.

As for moderation and mediator variables, we identified three dimensions of channels that are closely related to *DFC*. The first is the digital dimension, testing whether *Online sale* is a significant mediation channel, and whether *Social media* is a significant moderation channel, where both variables measure whether the respondent used those digital services. The second is the borrowing channel, testing whether *Bank loan* or *Informal loan* are significant mediation channels, where *Bank loan* indicates whether the household held any bank loan; *Informal loan* indicates whether the household held any informal loan for business. The third is the investment channel, testing whether *Liquidity investment*, *Insurance investment* or *Other financial investment* are significant mediation channels, where *Liquidity investment* measures whether the household reported having deposit and monetary fund with value no less than 3-month household consumption; *Insurance investment* measures whether the household reported holding any commercial insurance; *Other financial investment* measures whether the household reported investing in any financial instrument other than deposit, monetary fund or insurance.

4. Methodology

4.1 Baseline models

To explore the impact of *DFC* on household entrepreneurial performance, we first adopt equation (1) to examine its marginal effects on the four dependent variables. For *Business ownership* and *Business innovation*, probit models are adopted; while for *Business income* and *Business profit*, linear models are utilized.

$$Entre_{i,j} = a_j + b_j DFC_i + \beta_j X_j + \varepsilon_{i,j} \quad (1)$$

where, $Entre_{i,j}$ represents household i 's entrepreneurial performance, $j=1\sim 4$, specifying *Business ownership*, *Business innovation*, natural logarithm of *Business income*, and natural logarithm of *Business profit*, respectively. DFC_i represents household i 's *DFC*; vector X_1 represents the control variables for the entire sample, vector X_2 contains the same variables as X_3 or X_4 , representing the control variables for the business sample, which captures more business characteristics, as described in table 2. For model j , a_j is the constant, b_j is the coefficient of DFC_i , β_j is the coefficients vector of control variables, $\varepsilon_{i,j}$ is the error term of household i . Subscripts for variables, coefficients and error terms in following equations adopt analogous settings.

What cannot be ignored is that, there can be two-way relationships between *DFC* and dependent variables. Though we propose to look at the impact of *DFC* on household entrepreneurial performance, it is likely for households to become business owners first, or carried out innovation activities first, and then acquire *DFC* in an effort to optimize business operation. Besides, it is also possible for the business owners to make money first, and gain *DFC* while becoming rich, through the process of financial management. To address such endogeneity, we utilize *Use the Internet*⁴ as the instrumental variable for *DFC*. Similar to that in Yin, Gong and Guo (2019), *Use the Internet* is directly related to *DFC*, since all its componential variables require the connection of the Internet, while not directly related to household entrepreneurial activities, but instead has to realize impact through channels like those componential variables

⁴ In the 2017 CHFS questionnaire, respondents were asked, "Have you ever used the internet?" If the respondent answered "Yes", *use the Internet* was coded as 1, otherwise as 0.

constituting *DFC*. By checking IV strength by Kleibergen-Paap rk statistics, and exogeneity by DWH tests, we demonstrate the validity of model settings.

4.2 Function channels

To investigate how *DFC* impacts household entrepreneurial performance, we need to make assumptions on possible function channels.

Firstly, we surmise improvement of *DFC* would promote usage of *Online sale*, and then benefit household entrepreneurial performance. In the 2017 CHFS questionnaire, respondents were asked, “What do you usually do on the internet currently?” In the multiple-choice answer list, there was one answer related to *Online sale*, that is “Selling products and providing services (including selling agricultural products, applying for a job, publishing ads for house rent, publishing ads for individual lending, online auction, etc)”. From the description we can see that, the answer actually measures whether the respondent utilized the Internet as the channel for seeking income, which can probably lead to entrepreneurial behaviors.

Secondly, improvement of *DFC* may result in easier credit accessibility, including both *Bank loan* and *Informal loan*. Among the overwhelming changes digital finance has brought about, data accumulation stands out as the key to mitigate the difficulty MSMEs access loans. Thus, we assume that borrowing is the second channel that *DFC* impacts household entrepreneurial performance.

Thirdly, improvement of *DFC* would also help households manage their portfolios, and influence *Liquidity investment*, *Insurance investment* as well as *Other financial investment* (Jack and Suri, 2011; Nandhi, 2012), which would no doubt impact their entrepreneurial activities, which, for households, are also sort of investment.

Apart from channels discussed above, Luo and Zeng (2020) shows that *Social media* is an important source of *Business innovation*, acting as a low-cost network of open innovation. We assume *Social media* can be a significant channel moderating how *Online sale* influences *Business innovation*, *Business income* and *Business profit*.

Therefore, we hypothesize that *DFC* impacts household entrepreneurial performance by broadening income-seeking channel through *Online sale*, increasing credit accessibility through *Bank loan* and *Informal loan*, influencing investment through *Liquidity investment*, *Insurance investment*, and *Other financial investment*, while *Social media* may act as a moderator.

We utilize generalized structural equation models (GSEM) to check validity of hypothesized function channels. The model processes are described by equation (2) to equation (5). Subscripts for variables, coefficients and error terms follow analogous formats as those in equation (1). For example, models subscripted by $j=1$ are all for examining functional channels through which *DFC* impacts *Business ownership*. Based on Hayes (2013), we calculate the direct and indirect effects of *DFC* on household *Business ownership*, *Business innovation*, *Business income* and *Business profit*.

$$Mediator_{i,j,k} = c_{j,k} + d_{j,k}DFC_i + \theta_{j,k}X_j + \epsilon_{i,j,k} \quad (2)$$

where, $j=1\sim 4$, representing the four model systems corresponding to the four dependent variables. The major cause leading to different coefficients in equation (2) are the control variables vector X_j . $k=1\sim 6$, representing the 6 mediator variables, namely, *Online sale*, *Bank loan*, *Informal loan*, *Liquidity investment*, *Insurance investment*, *Other financial investment*.

For $j=1$, $Entre_{i,j} = Business\ ownership_i$,

$$Business\ ownership_i = e_1 + f_1 DFC_i + \sum_{k=1}^6 \gamma_{1,k} Mediator_{i,1,k} + \rho_1 X_1 + \mu_{i,1} \quad (3)$$

Based on Luo and Zeng (2020), *Social media* significantly impacts *Business innovation*, rather than *Business ownership*, thus, for $j=1$, $Online\ sale_{i,j} * Social\ media_{i,j}$ and $Social\ media_{i,j}$ are not included in the final equation, while for $j=2$, included.

For $j=2$, $Entre_{i,j} = Business\ innovation_i$,

$$Business\ innovation_i = e_2 + f_2 DFC_i + \sum_{k=1}^6 \gamma_{2,k} Mediator_{i,2,k} + m_2 Online\ sale_i * Social\ media_i + n_2 Social\ media_i + \rho_2 X_2 + \mu_{i,2} \quad (4)$$

For $j=3$ and 4 , $Entre_{i,j}$ represents natural logarithms of *Business income_i* and *Business profit_i* respectively. As *Business innovation* can be an important source of better financial performance, we include it in the equation to examine functional channels of how *DFC* impacts *Business income* and *Business profit*.

$$Entre_{i,j} = e_j + f_j DFC_i + q_j Business\ innovation_i + \sum_{k=1}^6 \gamma_{j,k} Mediator_{i,j,k} + m_j Online\ sale_i * Social\ media_i + n_j Social\ media_i + \rho_j X_j + \mu_{i,j} \quad (5)$$

5. Empirical results

5.1 Descriptive statistics

Table 2 show the descriptive statistics of variables for both the entire sample and the business sample. In the entire sample for studying *DFC* and *Business ownership*, 13.87% of households owned businesses, the average *DFC* score was 1.36, relatively low concerning the max score being 6. Among the componential variables, *Self-service banking* had the highest adoption rate as 44.16%, while *Online financial investment* had the lowest adoption rate as 7.74%. What is worth noticing is that, the adoption rate of *Mobile payment* had exceeded that of *Online/mobile banking* and *Computer payment*. With regard to respondent and household characteristics, the average *Age* of respondents⁵ was about 54 years old, 49.47% of whom were *Female*, and 82.70% were *Married*. In the 2017 CHFS questionnaire, education level means whether the respondent had ever registered and entered that level of school, from which he/she may have graduated or not. We chose the level *High school or higher* because the compulsory education period in China is from primary school to junior middle school. *High school or higher* means the respondent had surely finished the compulsory education. Shown by the statistics, 35.98% of respondents reached that level of education. In addition, we use the variable *Risk tolerant*⁶ as the indicator for risk preference, which may well influence their probability of becoming entrepreneurs. The average family size was around 3 members. 31.35% of surveyed households lived in rural areas, 33.10% had at least one family member whose health was poor, 33.34% had at least one child 15 years old or below, and 52.45% had at least one elder 60 years old or above. The average

⁵ We adopt the demographics of the respondent who answered all the questions for the household, as required by the survey, the respondent should be the one who knew best about household economic conditions.

⁶ In the 2017 CHFS questionnaire, respondents were asked, "Which of the choice below do you want to invest most if you have adequate money?" We define *Risk tolerant* as 1 if the respondent reported preferring average or above risk and return.

household asset was 1,127,330 yuan. The numbers of entrepreneurial households in surveyed communities ranged from 0 to 23, with the average a little above 4.

In the business sample for studying *DFC*'s impact on *Business innovation*, *Business income* and *Business profit*, consisting of households who reported running businesses, 16.93% executed innovative activities, average annual *Business income* was 305,657.44 yuan, while average annual *Business profit* was 101,939.84 yuan, from which we can confirm that most businesses in the sample were very small or micro. With respect to *DFC*, the statistics went along with our expectation that the score and adoption rate of each componential variable were significantly higher than those in the entire sample. Regarding demographic characteristics, respondents were over 8 years younger than the entire sample on average, 2.12% fewer were *Female*, 4.33% more were *Married*, and 6% more entered *High school or higher*, 11.43% more were *Risk tolerant*. Nearly 10% fewer households lived in rural areas. The average number of entrepreneurial households for business sample was 6.81, 70% more than that of the entire sample. As for business characteristics, the average business history was 10.34 years, 9.17% of business owners had online businesses, 5.15% cooperated with government, and 12.40% received policy benefit. 27.46% of business owners started the business for the possibility to earn more, while 11.48% did it for ambition⁷ and 29.71% for freedom, which can act as one indicator for nonpecuniary benefits preference. 81.42% of surveyed businesses were individual businesses, while 8.42% of which were informally organized. Average business investment was 194628.08 yuan.

Table 2. Descriptive statistics on sample socioeconomic characteristics

Variables	N	Mean	Sd	Min	Max
Entire sample					
<i>Business ownership</i> (%)	38,506	13.87	34.57	0	100
<i>DFC</i> (#)	38,506	1.36	1.70	0	6
<i>Self-service banking</i> (%)	38,506	44.16	49.66	0	100
<i>Online/mobile banking</i> (%)	38,506	25.73	43.72	0	100
<i>Computer payment</i> (%)	38,506	10.82	31.06	0	100
<i>Mobile payment</i> (%)	38,506	27.61	44.71	0	100
<i>Online financial investment</i> (%)	38,506	7.74	26.72	0	100
<i>Credit card</i> (%)	38,506	19.69	39.76	0	100
Respondent and household characteristics					
<i>Age</i> (years)	38,506	53.89	15.06	16	90
<i>Female</i> (%)	38,506	49.47	50.00	0	100
<i>Married</i> (%)	38,506	82.70	37.82	0	100
<i>High school or higher</i> (%)	38,506	35.98	48.00	0	100
<i>Risk tolerant</i> (%)	38,506	26.09	43.91	0	100
<i>Family size</i> (#)	38,506	3.16	1.54	1	15
<i>Rural</i> (%)	38,506	31.35	46.39	0	100
<i>Poor health</i> (%)	38,506	33.10	47.06	0	100
<i>Has child</i> (%)	38,506	33.34	47.14	0	100
<i>Has elder</i> (%)	38,506	52.45	49.94	0	100
<i>Household asset</i> (CNY)	38,506	1127330.	2291239.	0	30000000
<i>Entre households in community</i> (#)	38,506	4.19	3.55	0	23
Business sample					
<i>Business innovation</i> (%)	4974	16.93	37.50	0	100
<i>Business income</i> (CNY)	4974	305657.4	985407.1	0	8000000
<i>Business profit</i> (CNY)	3996	101939.8	371772.8	-	5000000

⁷ In the 2017 CHFS questionnaire, respondents were asked, “Why did your household start a business?” We define ‘Business for ambition’ as 1 if the respondent chose ‘Ideal job/Entrepreneurial drive’.

<i>DFC</i> (#)	4974	2.23	1.80	0	6
<i>Self-service banking</i> (%)	4974	62.48	48.42	0	100
<i>Online/mobile banking</i> (%)	4974	46.16	49.86	0	100
<i>Computer payment</i> (%)	4974	19.24	39.42	0	100
<i>Mobile payment</i> (%)	4974	49.72	50.00	0	100
<i>Online financial investment</i> (%)	4974	13.53	34.21	0	100
<i>Credit card</i> (%)	4974	31.77	46.56	0	100
Respondent and household characteristics					
<i>Age</i> (years)	4974	45.48	12.82	16	85
<i>Female</i> (%)	4974	47.35	49.93	0	100
<i>Married</i> (%)	4974	87.03	33.60	0	100
<i>High school or higher</i> (%)	4974	41.98	49.36	0	100
<i>Risk tolerant</i> (%)	4974	37.52	48.42	0	100
<i>Rural</i> (%)	4974	21.41	41.02	0	100
<i>Entre households in community</i> (#)	4974	6.81	3.95	1	23
Business characteristics					
<i>Business history</i> (years)	4974	10.34	9.25	0	117
<i>Business online</i> (%)	4974	9.17	28.86	0	100
<i>Cooperated with government</i> (%)	4974	5.15	22.10	0	100
<i>Received policy benefit</i> (%)	4974	12.40	32.97	0	100
<i>Business for more money</i> (%)	4974	27.46	44.64	0	100
<i>Business for ambition</i> (%)	4974	11.48	31.88	0	100
<i>Business for freedom</i> (%)	4974	29.71	45.70	0	100
<i>Business form - Individual business</i> (%)	4974	81.42	38.90	0	100
<i>Business form - Informally organized</i> (%)	4974	8.42	27.78	0	100
<i>Business invest</i> (CNY)	4974	194628.0	822390.5	0	30000000

Notes: (1) For brevity, we do not list province and industry dummies in the table. (2) All monetary variables shown in the table were kept as CNY value upon survey time, and transformed by natural logarithm when computed in models in this paper.

5.2 Digital financial capability and household business ownership

Regression (1) in Table 3 shows the probit result on the association between *DFC* and household *Business ownership*, from which we can see that, having higher *DFC* was positively associated with being a business owner. The coefficients of control variables demonstrate expected relationships: the probability for a household to be a business owner rose with respondent's age first and went down later. Male and less-educated respondents⁸, households with more members and higher asset value, residing in rural areas or communities with more entrepreneurial neighbors, in good health condition, without children or elders, were more likely to be business owners.

Nevertheless, *DFC* may be endogenous concerning *Business ownership*. As discussed in the methodology section, it is possible that entrepreneurs gained *DFC* after the business had already been started. In order to address endogeneity, we adopt the instrumental variable *Use the Internet*, and carry out two-step IV probit estimation by Control Function Approach. From the Kleibergen-Paap rk statistics, we can conclude that there is no under identification or weak instrument issues. In order to confirm the necessity of IV estimation, Durbin-Wu-Hausman test was conducted. The statistics reject the null hypothesis that the explanatory variable is exogenous. Hence, the instrumental variable is valid and the IV regression is necessary. Shown by regression (2), with other variables at means, one-unit increase in *DFC* score from its mean

⁸ Recall that the respondent was designed and required by the survey, to be the one who knew best about household economic conditions.

results in a 1.56% increase in the probability of a household being a business owner, at 1% confidence level.

Table 3. Digital financial capability and household business ownership

Dependent variable: <i>Business ownership</i>	(1) Probit	(2) IV Probit
<i>Digital financial capability score (DFC)</i>	0.0058*** (0.0013)	0.0156*** (0.0044)
N	38,506	38,506
Kleibergen-Paap rk LM statistic:	2765.30	
Kleibergen-Paap rk Wald F statistic:	2975.92	
- Stock-Yogo weak ID test critical values: 10% maximal IV size	16.38	
Durbin (score) chi2(1):	12.75 (p = 0.0004)	
Wu-Hausman F (1,38462):	12.74 (p = 0.0004)	

Notes: (1) All control variables were included. (2) Standard errors in parentheses, clustered at community level for the Probit model, obtained from bootstrapping with 1000 replications by Control Function Approach for the IV Probit model. Stars show the significance of marginal effects, *** p<0.01.

Table 4 presents the mediation channels through which *DFC* impacts *Business ownership*. All assumed channels but *Informal loan* have significant indirect effects at 1% confidence level. In order to compare the indirect effects with total effect, we calculate the percentage each mediation channel contributes. The direct effect of *DFC* accounts for 14.44% of total effect, while indirect effects take up as much as 85.56%. It is intriguing that there are both positive and negative mediation channels. The greatest indirect effect is through *Online sale*, that is, controlling for all other mediators in the model, *Online sale* contributes more than 100% of total effect. Comparatively, *Bank loan* only mediates 7.68% of total effect. With regard to the three investment channels, it is worth noting that *Insurance investment* contributes nearly twice the indirect effect of *Liquidity investment*, demonstrating that an important channel for *DFC* to promote *Business ownership* is through the provision of a risk floor so that households have more confidence to start their own businesses (Cole, Giné and Vickery, 2017). Oppositely, *Other financial investment*, which often consists of medium or high-risk investment, mediates negatively nearly half of total effect. This goes along with the existing literature that, on one hand, business owners usually invest most of their surplus in their own businesses (Gentry and Hubbard, 2004); on the other hand, Luo and Zeng (2020) also shows negative relationship between diversified investment and household entrepreneurial decisions.

In brief, *DFC* positively promotes different sorts of household investment, however, different channels of investment can have both positive and negative impacts on *Business ownership*. From our examination, the net indirect effect through investment is negative. *Online sale* is the most prominent mediator, while those in the borrowing dimension account for relatively small percentage of total effect.

Table 4. Mediation channels through which digital financial capability impacts household business ownership

Dependent variable: <i>Business ownership</i> N=38,506	Effects	% in total effect
Direct (<i>DFC</i>)	0.0173**	14.44%

effect	1)	(0.0075)	
Indirect effects	2) (<i>Online sale</i>	0.1255*** (0.0102)	104.76%
	3) (<i>Informal loan</i>	0.0710 (0.0792)	0.00%
	4) (<i>Bank loan</i>	0.0092*** (0.0028)	7.68%
	5) (<i>Liquidity investment</i>	0.0093*** (0.0022)	7.76%
	6) (<i>Insurance investment</i>	0.0170*** (0.0044)	14.19%
	7) (<i>Other financial investment</i>	-0.0585*** (0.0081)	-48.83%

Notes: (1) All results in the table were computed by generalized structural equation model (GSEM), control variables were included. (2) Standard errors in parentheses. Based on Hayes (2013), standard errors of indirect effects were obtained by bootstrapping with 5000 replications. Stars show the significance of GSEM effects, ** p<0.05, *** p<0.01.

5.3 Digital financial capability and household business innovation

Regression (1) in Table 5 presents the probit result on the association between *DFC* and household *Business innovation*, showing having higher *DFC* was also positively associated with *Business innovation*. To address endogeneity, we also utilize *Use the Internet* as the instrumental variable and adopt Control Function Approach to conduct IV probit regression. From the Kleibergen-Paap rk statistics, we can see that there is no under identification or weak identification issues. The results of Durbin-Wu-Hausman test reject the hypothesis that the explanatory variable is exogenous. Therefore, the IV is valid and it is necessary to deal with endogeneity. According to the result of regression (2), *DFC* improves the probability of *Business innovation* significantly. With other variables at mean values, one-unit increase in *DFC* score from its mean, results in a 7.25% increase in the probability of a business owner executing innovative activities at 1% confidence level.

Table 5. Digital financial capability and household business innovation

Dependent variable: <i>Business innovation</i>	(1) Probit	(2) IV Probit
<i>DFC</i>	0.0206*** (0.0033)	0.0725*** (0.0138)
N	4,974	4,974
Kleibergen-Paap rk LM statistic:	390.56	
Kleibergen-Paap rk Wald F statistic:	418.30	
- Stock-Yogo weak ID test critical values: 10% maximal IV size	16.38	
Durbin (score) chi2(1):	8.4407 (p = 0.0037)	
Wu-Hausman F (1,4908):	8.3428 (p = 0.0039)	

Notes: (1) All control variables were included. (2) Standard errors in parentheses, clustered at community level for the Probit model, obtained from bootstrapping with 1000 replications by Control Function Approach for the IV Probit model. Stars show the significance of marginal effects, *** p<0.01.

Table 6 presents the mediation channels through which *DFC* impacts *Business innovation*. Among the six assumed mediator variables, *Informal loan* and *Liquidity investment* do not show significant indirect effects. For brevity, we do not list insignificant mediators in the table. Without the moderation of social media, direct effect of *DFC* constitutes nearly all of total effect, indicating mediators almost offset each other's indirect effect. Similar to that in Table 4, *Other financial investment* contributes negatively half the total effect, while *Insurance investment* and *Bank loan* contributes 34.63% and 16.93% respectively. The result indicates that, for business owners, investment in medium or high-risk financial instruments would decrease the probability that they execute innovative activities, which might also be seen as risky investment. Through both *Insurance investment* and *Bank loan*, *DFC* increases the propensity that business owners implement *Business innovation*. By taking *Social media* as a moderator of *Online sale*, the indirect effect of *Online sale* turns significant and contributes more than half of total effect if the respondent did use *Social media*, confirming it as a critical source of innovative activities for micro or small businesses.

In brief, *DFC* increases the probability of business owners implementing *Business innovation* through interaction with *Social media*, which may act as a low-cost network of open innovation (Huston and Sakkab, 2006). Apart from that, *DFC* also promotes *Business innovation* through improving accessibility of *Bank loan* and increasing confidence by promoting adoption of *Insurance investment* as a risk floor. By encouraging *Other financial investment*, *DFC* also leaves negative impact on *Business innovation*.

Table 6. Mediation channels through which digital financial capability impacts household business innovation

Dependent variable: <i>Business innovation</i> N=4,974		Effects	% in total effect	
			Not use social	Use social media
Direct effect	(1) <i>DFC</i>	0.0638*** (0.0169)	99.07%	48.55%
	(2) <i>Online sale</i>	0.0222 (0.0425)	0.00%	—
	(3) <i>Online sale</i> - moderated by <i>Social media</i>	0.0670*** (0.0162)	—	50.99%
Indirect effects	(4) <i>Bank loan</i>	0.0109* (0.0064)	16.93%	8.30%
	(5) <i>Insurance investment</i>	0.0223** (0.0096)	34.63%	16.97%
	(6) <i>Other financial investment</i>	-0.0326* (0.0180)	-50.62%	-24.81%

Notes: (1) All results in the table were computed by generalized structural equation model (GSEM), control variables were included. (2) Standard errors in parentheses. Based on Hayes (2013), standard errors of indirect effects were obtained by bootstrapping with 5000 replications. Stars show the significance of GSEM coefficients, * p<0.1, ** p<0.05, *** p<0.01.

5.4 Digital financial capability and household business financial performance

Regression (1) and (4) in Table 7 present the linear results on the relationships between *DFC* and household business financial performance, showing positive associations between *DFC* and *Business income*, as well as between *DFC* and *Business profit*. To deal with possible endogeneity, as discussed in the methodology section, we continue to conduct 2SLS regressions, adopting

‘Use the Internet’ as the IV for *DFC*. From the Kleibergen-Paap rk statistics, we can conclude that the instrumental variable is not weak. However, according to Durbin-Wu-Hausman tests, we cannot reject the hypothesis that the explanatory variable is exogenous, which means the results of OLS regressions would be more consistent.

To double check the validity of the 2SLS results, we utilize the Gaussian Copula Approach proposed by Park and Gupta (2012). With the prerequisite of the possibly endogenous regressor being non-normal, the Gaussian Copula Approach does not require IVs from outside, but instead models the joint distribution of the endogenous explanatory variable and the error term. Statistically, the endogenous part of the endogenous regressor is estimated and generated as an additional regressor, P^* . Similar to the way of Control Function Approach, P^* is added to the equation to control the endogeneity of the explanatory variable. Meanwhile, the significance of P^* 's coefficient indicates whether there is significant endogeneity. By confirming *DFC* non-normal, we estimate the 2SLS again by the Gaussian Copula Approach. From Table 7, we can see that the result is similar to that obtained by 2SLS and the significance of P^* 's coefficient indicates there is no significant endogeneity. Therefore, we should stick to the OLS results. At 1% confidence level, one-unit increase of *DFC* score from its mean, would result in 10.36% more *Business income*, and 13.31% more *Business profit*.

Table 7. Digital financial capability and household business financial performance

Variables	<i>Ln (Business income)</i>			<i>Ln (Business profit)</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	2SLS-Copula	OLS	2SLS	2SLS-Copula
<i>DFC</i>	0.1036*** (0.0275)	0.2192** (0.0885)	0.1965** (0.0656)	0.1331** (0.0568)	-0.104 (0.1972)	-0.0741 (0.1371)
P^* (Gaussian Copula Approach)			-0.1762 (0.1185)			0.3978 (0.2449)
N	4974	4974	4974	3996	3996	3996
Kleibergen-Paap rk LM statistic:	390.56			308.05		
Kleibergen-Paap rk Wald F statistic:	418.3			328.35		
Durbin (score) chi2(1):	1.6034 (p=0.2054)			1.4368 (p=0.2307)		
Wu-Hausman	F (1,4908): 1.5826 (p=0.2084)			F (1,3930): 1.4135 (p=0.2345)		

Notes: (1) Stock-Yogo weak ID test critical value for 10% maximal IV size is 16.38. (2) All control variables were included. (3) Standard errors in parentheses, clustered at community level for the OLS and 2SLS models, obtained from bootstrapping with 1000 replications by Gaussian Copula Approach for the 2SLS-Copula models. Stars show the significance of marginal effects, ** p<0.05, *** p<0.01.

Table 8 shows the mediation effects for *Business income* and *Business profit*. Among the assumed mediator variables, *Informal loan* does not show significant indirect effect regarding *Business income*, while *Bank loan* and *Other financial investment* do not show significant indirect effects regarding *Business profit*. For brevity, we do not list insignificant mediators. Since we include *Business innovation* as one of mediators for financial performance, the channel ‘*Online sale* → *Business innovation*’ means a serial mediation path from *DFC* through *Online sale*, *Business innovation* and finally to *Business income* or *Business profit*.

For *Business income*, significant mediation channels include *Business innovation*, *Online sale* moderated by *Social media* through *Business innovation*, *Bank loan*, *Bank loan* through *Business innovation*, *Liquidity investment*, *Insurance investment* through *Business innovation*, as well as *Other financial investment* through *Business innovation*. Among all the significant mediators, *Liquidity investment*, *Business innovation* and *Bank loan* are the variables that mediate most effects if the household did not use social media. Comparatively, if the household did use social media, the three most prominent mediators were *Liquidity investment*, *Online sale* moderated by *Social media* through *Business innovation*, as well as *Business innovation*.

For *Business profit*, significant mediation channels include *Business innovation*, *Online sale* moderated by *Social media* through *Business innovation*, *Informal loan*, *Liquidity investment*, as well as *Insurance investment* through *Business innovation*. Among all the significant mediators, *Liquidity investment*, *Informal loan* and *Business innovation* are the variables that mediate most effects no matter whether households used social media or not.

Table 8. Mediation channels through which digital financial capability impacts household business financial performance

Channels		<i>Ln (Business income)</i>			<i>Ln (Business profit)</i>		
		Effects	% in total effect		Effects	% in total effect	
			Not use social	Use social media		Not use social	Use social
Direct effect	(1) <i>DFC</i>	0.0626** (0.0270)	35.15%	28.90%	0.1070* (0.0592)	33.66%	30.33%
	(2) <i>Business innovation</i>	0.0366*** (0.0124)	20.55%	16.90%	0.0332** (0.0174)	10.44%	9.41%
	(3) <i>Online sale → Business innovation</i>	0.0128 (0.0220)	0.00%	—	0.0116 (0.0205)	0.00%	—
	(4) <i>Online sale → Business innovation - moderated by Social media</i>	0.0385*** (0.0113)	—	17.77%	0.0349** (0.0178)	—	9.89%
	(5) <i>Bank loan</i>	0.0334*** (0.0108)	18.75%	15.42%			
Indirect effects	(6) <i>Bank loan → Business innovation</i>	0.0063* (0.0037)	3.54%	2.91%			
	(7) <i>Informal loan</i>				0.0517* (0.0263)	16.26%	14.65%
	(8) <i>Liquidity investment</i>	0.0451*** (0.0100)	25.32%	20.82%	0.1144*** (0.0229)	35.99%	32.43%
	(9) <i>Insurance investment → Business innovation</i>	0.0128** (0.0060)	7.19%	5.91%	0.0116* (0.0073)	3.65%	3.29%
	(10) <i>Other financial investment → Business innovation</i>	-0.0187* (0.0113)	-10.50%	-8.63%			
N			4,974			3,996	

Note: 1. All results in the table were computed by generalized structural equation model (GSEM), control variables were included. Stars show the significance of GSEM coefficients, * p<0.1, ** p<0.05, *** p<0.01. 2. Standard errors in parentheses. Based on Hayes (2013), standard errors of indirect effects were obtained by bootstrapping with 5000 replications.

5.5 Heterogeneity across socioeconomic populations

Table 9 presents the marginal effects of *DFC* on the four dependent variables across socioeconomic populations, grouped by low/high income⁹, age cohorts and educational attainment. There are distinct patterns that should not be overlooked.

To be specific, *DFC*'s marginal effects on *Business ownership* are more pronounced for low-income, middle-aged populations, with lower educational attainment level. The rationality is embedded in the characteristics of both human capital and digital financial technologies. Generally, populations, who earn low income, with lower educational attainment level may find it harder to meet formal employment requirement. Regarding the middle-aged, the situation would be even harder for them than younger workers. Fortunately, the widely connected, efficient and low-cost features of digital financial services in China have helped create a well-functioning ecosystem to benefit them in running their own businesses. Such distinct patterns leave us inspirations for future policy emphasis, to promote *DFC* of those vulnerable populations.

With respect to *Business innovation*, greater marginal effects are seen for more populations, with those for low/high income, and low/high educational attainment being similar, that for the elder cohort even larger than the middle-aged, indicating *DFC* promotes *Business innovation* quite evenly across different populations, not necessarily benefiting the digitally sophisticated only.

As for financial performance, marginal effects are generally larger for high-income and younger populations, with lower educational attainment level. According to Table 2, those who attended junior high school or lower educational levels account for 64.02% of the entire sample and 58.02% of the business sample. The improvement of *DFC* seems to act as an opportunity for post-school human capital building, so that those who missed the chance of attaining much education before adulthood can be better included in the digital era.

Table 9. Heterogenous impacts of digital financial capability across different socioeconomic populations

Dependent variables	(1) Low income	(2) High income	(3) Age 16~35	(4) Age 36~59	(5) Age 60 & above	(6) Junior high or lower	(7) High school or higher
<i>Business ownership</i>	0.0579** *	0.0049	0.0446	0.0518**	-0.0016	0.0426**	-0.0079
	(0.0218)	(0.0223)	(0.0479)	(0.0222)	(0.0184)	(0.0165)	(0.0234)
<i>N</i>	19196	19276	5111	18318	15043	24624	13848
<i>Business innovation</i>	0.0684** *	0.0659**	0.0412	0.0682** *	0.0868** *	0.0587** *	0.0598*
	(0.0150)	(0.0262)	(0.0503)	(0.0186)	(0.0264)	(0.0136)	(0.0356)
<i>N</i>	2098	2864	1180	3066	591	2865	2088
<i>Ln (Business income)</i>	0.0368	0.0763**	0.1233*	0.0825**	0.1037	0.1376** *	0.0752
	(0.0491)	(0.0331)	(0.0657)	(0.0327)	(0.0936)	(0.0315)	(0.0473)
<i>N</i>	2110	2864	1180	3066	728	2886	2088
<i>Ln (Business profit)</i>	-0.0374	0.1049*	0.2886**	0.0524	0.2882**	0.2057** *	0.0741
	(0.1236)	(0.0580)	(0.1442)	(0.0693)	(0.1329)	(0.0658)	(0.1001)
<i>N</i>	1463	2533	940	2464	592	2329	1667

Note: (1) Instrumental variable was utilized according to exogeneity tests above. (2) Standard errors in parentheses, for IV Probit regressions regarding *Business ownership* and *Business innovation*, we obtained standard errors by using Control Function

⁹ Low/ high income samples were split by the median value of household income per capita.

Approach and bootstrapping with 1000 replications; for OLS regressions regarding business financial performance, standard errors were clustered at community level. Stars show the significance of marginal effects at means, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. (3) Different sample sizes concerning the same population were caused by some variables not used for collinearities after the entire sample being split into different populations.

6. Conclusions

This study utilizes data from 2017 CHFS to investigate the relationship between *Digital financial capability (DFC)* and household entrepreneurial performance. Overall, *DFC* has significant and positive impact on *Business ownership*, *Business innovation*, *Business income* and *Business profit*. The results still hold after dealing with endogeneity issues. Concerning how *DFC* influences household entrepreneurial performance, mediation channels are not all the same regarding the four dependent variables. With respect to household *Business ownership*, predominant mediation effect is contributed by *Online sale*, accounting for as much as 104.76% of total effect. Percentages taken by *Bank loan*, *Liquidity investment*, *Insurance investment* as well as *Other financial investment* are 7.68%, 7.76%, 14.19% and -48.83% respectively, indicating *Other financial investment* might be an important substitute for household business, which can also be regarded as a type of risky investment. With respect to *Business innovation*, *Online sale* moderated by *Social media* provides prominent mediation effect, contributing as much as 50.99% of the total effect, if the business owner did use social media. Percentages taken by *Bank loan*, *Insurance investment* and *Other financial investment* are 8.30%, 16.97% and -24.81% respectively. However, if household did not use social media, the total indirect effects took up less than 1% of total effect, because the mediation effect of *Online sale* was not significant when social media was not used, and percentages taken by *Bank loan*, *Insurance investment* and *Other financial investment* are 16.93%, 34.63% and -50.62% respectively, offsetting each other almost to 0. With respect to *Business income* and *Business profit*, *Liquidity investment* is the most standout mediation channel, while *Other financial investment* contributes much smaller negative indirect effects than those in the models for the first two dependent variables. It also draws attention that business innovation is a significant mediator for both *Business income* and *Business innovation*.

As for heterogeneity across different populations, *DFC* especially empowers those with low income to run their own businesses and implement innovative activities, while enabling those with lower education attainment to earn more.

Compared with previous studies, this paper extends the existing literature in three folds. Firstly, we are among the first to define *DFC*, in order to raise awareness that the capability to fully and properly make use of digital financial products and services has become increasingly important for micro economic lives in the digital era. Secondly, multidimensional dependent variables and functional channels are taken into consideration, which help provide a good exploration and description on how *DFC* impacts household entrepreneurial performance. Thirdly, heterogenous impacts are also demonstrated for further policy implications.

It is important for financial inclusion policies, especially those targeted at MSME financial services, to be paired with capability building programs to promote *DFC*. It is pivotal for policy makers to be aware about the implication provided by our examination of mediation channels. By building households' *DFC*, households can make better use of *Online sale* to start and optimize their own businesses, and more easily access credit and investment products. The improvement of *DFC* usually starts with adopting basic digital financial services, like digital payment. By observing recent development in the area, it is possible that the simple adoption of digital payment can then evolve into usage of many other digital financial services, through the

accumulation of payment data records. It would be forward-looking for national strategies to make and implement effective data regulations, in order to sustain an empowering environment for people to improve *DFC* and achieve better livings, through entrepreneurial, for example. It is also necessary to provide households with guidelines for risky asset holdings, so that households can better control risk levels and enjoy asset growth.

In our study, we have tried our best to ensure the robustness of measurement and regressions. However, our measure of *DFC* is still subject to data availability from existing surveys. For future studies, there is the need to keep the assessment of *DFC* up to latest development of the area.

This paper is distinguished from most studies around MSMEs finance in that, it sets out from the research subjects of households, as well as the real time characteristic of micro economic lives in the digital era, to depict the situation where people's adaptability to digitization is playing a more and more important role in their living-making, demonstrating detailed insights on how *DFC* influences household entrepreneurial performance. Above all, we provide an exploration and a starting point for future scholars and policy makers to take the challenges brought by evolution of financial industry seriously and profoundly.

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