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**E-COMMERCE DEVELOPMENT
AND ENTREPRENEURSHIP IN THE
PEOPLE'S REPUBLIC OF CHINA**

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Abstract

In this paper, we utilize an e-commerce development indicator in tandem with big data to measure the variations of e-commerce development across counties in the People's Republic of China and assess its impact on entrepreneurship in both rural and urban areas. We find that households living in counties with higher levels of e-commerce development are more likely to run their own businesses. Further study indicates that e-commerce development not only significantly increases the entry of new startups but also decreases the exit of incumbent businesses. Moreover, we find that e-commerce development induces sectoral change of household entrepreneurship. It promotes the entrepreneurship in the manufacturing and wholesale sectors, but reduces the entrepreneurship in the retail, hotel, and catering sectors. In addition, we show that e-commerce prosperity fuels entrepreneurship by alleviating the financial constraints and moderates the reliance of household entrepreneurship on social networks.

Keywords: e-commerce development, big data, entrepreneurship

JEL Classification: L81

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1. INTRODUCTION

With the rapid penetration of e-commerce into various fields, the role of e-commerce in economic development has attracted much attention and debate among academics and policy makers. Supporters of e-commerce recognize its important role in upgrading traditional industries and regard it as a new engine for economic development. Opponents argue that e-commerce development crowds out retail stores, which in turn exacerbates unemployment and impedes economic growth. Despite the hot debates, our understanding of the impacts of e-commerce on real economic activities is still limited. This is partially due to the difficulty in measuring e-commerce development with any precision, especially in remote and rural areas, since e-commerce transaction data are usually not publicly available. In this paper, we utilize an e-commerce development indicator constructed with big data to gauge the variations of e-commerce development across counties in the People's Republic of China and assess its impact on entrepreneurship in both rural and urban areas.

According to the definition given by Statistics Denmark, "Transactional electronic commerce is the sale of goods or services over the Internet, at any stage in the supply chain, whether between businesses, between businesses and consumers, or between the public and private sectors. The sale is based upon on-line ordering, but ultimate delivery of the good or service may be conducted on or off-line." This indicates that e-commerce development will bring more entrepreneurial opportunities and encourage massive physical startups of small and micro enterprises (George et al. 2016). The online shops operating on e-commerce platforms need the support of offline orders, settlement, warehousing, distribution, installation, after-sales service, and other businesses. The prosperity of e-commerce development will hence promote startups which serve for e-commerce enterprises, such as wholesale and courier service firms, etc. Meanwhile, e-commerce enlarges the market size of traditional firms because it breaks up the geographical and time restrictions of transactions. Moreover, the prosperity of e-commerce makes the entrepreneurial environment become more dynamic, encourages people to take up e-commerce technology, and facilitates the management and operation of enterprises run by incumbent entrepreneurs.

In this paper, we study the impact of e-commerce on entrepreneurship in the Chinese context. The PRC provides a compelling setting for exploring this question. On one hand, e-commerce has grown rapidly in the PRC in recent years. The proportion of online retail transactions to total retail sales of consumer goods has climbed rapidly from 1.1% in 2008 to 12.9% in 2015.¹ By 2013, the PRC had already become the largest e-commerce market in the world. On the other hand, entrepreneurial activities are booming in the PRC. According to Herrington and Kew (2017), the overall rate of PRC entrepreneurial activities ranks relatively high among 65 world economies. However, the exit rate of entrepreneurial activities in the PRC is also very high. According to the China Household Finance Survey data of 2013 and 2015, about one-third of entrepreneurs exited the market from 2013 to 2015. Moreover, as is noted by the GEM report 2016, most entrepreneurial activities are concentrated in customer service industries with low innovation. Despite the rapid growth of e-commerce, few studies have examined its impact on individual behavior, especially on entrepreneurship.

¹ Data are released by the National Bureau of Statistics.

In contrast with the existing literature, we employ a unique e-commerce development indicator in tandem with big data to gauge the variations of e-commerce development across PRC counties. This indicator is constructed and issued by AliResearch, the research institute of Alibaba, which is now the world's largest e-commerce, retail, internet, and technology conglomerate.² Using the large scale of transaction data on the platforms of Taobao.com and Tmall.com, AliResearch constructed an Online-business Development Index to reflect both online business development and online consumption in different parts of the country. With this index, we are able to measure precisely the development of e-commerce across PRC counties and to assess its impact on entrepreneurship.

Our analysis differs from the existing studies in the following respects. Firstly, we analyze not only the impacts of e-commerce on the physical establishment of new small and medium enterprises (SMEs, or offline business entities), but also its impacts on the operational performance of incumbent businesses. Moreover, we investigate how the prosperity of e-commerce changes Chinese households' motivation of entrepreneurship and sectoral choices of start-up businesses. Finally, we explore the potential mechanisms through which e-commerce promotes entrepreneurship in the PRC. We find that entrepreneurship is positively and significantly related to regional e-commerce development, and this relationship is more pronounced in rural areas. Further analysis shows that e-commerce increases the entry of new firms, improves the operational performance of new startup businesses, and decreases the exits of incumbent firms. Moreover, e-commerce encourages opportunity-driven entrepreneurship but decreases the number of startup businesses in the traditional sectors of retail, hotel, and catering. Our empirical evidence shows that e-commerce prosperity fuels household entrepreneurship through two mechanisms. On one hand, it alleviates the financial constraints facing household entrepreneurship by dramatically reducing the transactional and operational costs of business. On the other hand, it moderates the reliance of household entrepreneurship on social networks because e-commerce can easily extend trade beyond trust-based networks.

Using an e-commerce development indicator that is constructed with big data and covers various PRC counties, our paper contributes to the literature by studying the effect of e-commerce on real economic activities. The existing literature has widely discussed the impacts of e-commerce on business models from different perspectives, such as substitution between online and offline shopping for consumers (Goolsbee 2001; Scott Morton, Rizzo, and Zettelmeyer 2004), the difference in the price strategy and quality of goods between online and offline sales (Ellison and Ellison 2009; Chevalier and Goolsbee 2003; Brown and Goolsbee 2002), and the changes in market structure (Goldmanis et al. 2009). However, most studies focus on developed countries. Despite the rapid growth of e-commerce in the PRC, our knowledge of e-commerce in the PRC context is very limited. Fan et al. (2016) show that, by eliminating the fixed cost of entry for firms, e-commerce might disproportionately improve smaller cities' access to varieties of goods and reduce the inequality in living standards across cities. Dai and Zhang (2015) illustrate that the spread of e-commerce has enabled more people to become entrepreneurs because e-commerce reduces the reliance on social networks. In contrast with Dai and Zhang (2015), our paper pays more attention to the effect of e-commerce development on household entrepreneurship, which is rarely discussed in the existing literature. This research enriches our understanding of how entrepreneurship adjusts to the dynamic environment (Ambrosini, Bowman, and Collier 2009) and forms competitive advantages (Huang et al. 2015) in the volatile business environment triggered by the

² The detailed information of AliResearch can be found on its website <http://www.aliresearch.com/>.

prosperity of e-commerce. We also extend the frontier of the existing literature on entrepreneurship and small business (Gibb 1996) to the new business model of e-commerce.

The remainder of this paper is organized as follows: Section 2 briefly reviews the literature and builds up our framework; Section 3 presents the methodology and data used for empirical analysis; Section 4 reports the empirical results; and Section 5 concludes the paper.

2. LITERATURE REVIEW

E-commerce refers to using computer network and information technology to connect parties to transaction and to carry out all kinds of economic activities (Turban et al. 2004), such as sales of products and services, purchasing and publicity, search data and information, and so on (Bharadwaj and Soni 2007). E-commerce, which involves the marketing and distribution of products and services to consumers via the internet, has advantages for both retailers and consumers. Thus, the effect of e-commerce development has been much discussed in the literature, especially from the perspective of internet usage. From the macro perspective, the existing literature has investigated the impacts of e-commerce on economic growth, international trade, price competition, and financial development (Chevalier and Goolsbee 2003; Choi, Laibson, and Metrick 2002; Cronin 1998), while from the micro perspective e-commerce has been linked to employment, consumption decisions, time use, and welfare (Feldman and Klaas 2002; Song and Zahedi 2005; Tokunaga and Rains 2010; Lohmann 2015).

Despite the voluminous literature related to e-commerce, we still know little about the impacts of e-commerce development on entrepreneurship and its working mechanism. We argue that e-commerce affects entrepreneurial activities by triggering a dynamic change in the entrepreneurial environment. Changes and uncertainties in the entrepreneurial environment are important sources of entrepreneurial opportunities (Duncan 1972; Shane and Eckhardt 2003), and an entrepreneurial environment with dynamic changes implies more entrepreneurial opportunities (Zahra 1995). E-commerce development brings technological changes, diversifies market demand, and reduces information asymmetry, which will lead to the dynamic development of the entrepreneurial environment and result in an unbalanced state for the entrepreneurial market. As a result, the attractive market gap of deviation from equilibrium of the entrepreneurial market (Penrose 1959) will give birth to a large number of market opportunities for potential entrepreneurs (Holcombe 2003; Cohen and Winn 2007) and attract potential entrepreneurs to start up their own businesses. Moreover, the dynamic development of the entrepreneurial environment could also bring new market opportunities to incumbent entrepreneurs, which may promote the transformation and upgrading of existing firms, and finally reduce the exit of incumbent entrepreneurs. Therefore, we argue that e-commerce development has both an *entry* effect and an *exit* effect on entrepreneurship.

The main idea of the entry effect is that e-commerce development increases the propensity for potential entrepreneurs to become self-employed. When e-commerce prospers, the information asymmetry in the entrepreneurship market will become less severe, which facilitates the exploitation and utilization of entrepreneurial opportunities. At the same time, the diversification of consumer demand triggered by e-commerce will also bring in more entrepreneurship opportunities. Moreover, the boom of online shops at e-commerce platforms will boost massive physical startups because the operation of online shops requires support from offline order receiving, settlement, warehousing,

distribution, installation, after-sales service, and other businesses. Therefore, e-commerce development will promote startups that serve for e-commerce enterprises, such as wholesale startups, physical startups, and courier service firms, etc. At the same time, e-commerce development will also improve the utilization efficiency of entrepreneurial opportunities (George et al. 2016).

The primary idea of the exit effect is that e-commerce development will reduce the failure rate of incumbent entrepreneurs. The entities operating in a dynamic environment induced by e-commerce prosperity are more likely to adopt new techniques than entities operating in a stable environment (Miller 1987). E-commerce development technology regenerates traditional enterprises by creating “new competition” among incumbent entrepreneurial firms. E-commerce technology is a resource that physical enterprises can use to promote the sales of products and improve marketing efficiency. Meanwhile, e-commerce facilitates the data analysis of traditional entrepreneurial firms and enhances their understanding of market potentials (Peterson, Balasubramanian, and Bronnenberg 1997). E-commerce development broadens the market scope of traditional firms by breaking up the geographical and time restrictions of trading. E-commerce development also reduces information asymmetry inside physical SMEs. E-commerce development encourages traditional entrepreneurial firms to adopt modern management strategies and more transparent system.

3. DATA AND EMPIRICAL STRATEGY

3.1 Data Source and Summary Statistics

We measure the development of e-commerce with the China Online-business Development Index (aEDI) constructed by AliResearch. Using the big data from the platforms of Taobao.com and Tmall.com, AliResearch composes this index to gauge both online sales and online purchases across PRC counties. Details of the construction method and data sources are shown in Table 1. The e-commerce development index is the weighted average of the online business development indicator (aOBDI) and the online consumption indicator (aOCI). Its value ranges from 1 to 100, with larger values reflecting higher levels of e-commerce development. aOBDI is computed with the numbers of Taobao and Tmall shops and the trading volume of these shops in each county, while aOCI is constructed with the number of online consumers and the amount of consumption per capita for each county. Since the online consumption of local residents is not restricted to local online stores, we employ aOBDI in 2014 as the measurement of e-commerce development for each county in this paper.³

³ The online shopping level of local residents may affect their online participation degree more, which is not included in this paper.

Table 1: Construction Method and Data Source of E-commerce Development Indicator

First Class Indicator (weight)	Second Class Indicator (weight)	Calculation Method	Data Source
Online business development indicator (0.5)	Online business density indicator (0.6)	B2B online business density = Number of B2B online business/population Online retailer density = Number of online retailers/population	Number of B2B online business is the number of integrity membership by the end of November 2014. Number of online retailers is the number of online shops on Taobao.com and Tmall.com by the end of November 2014. Population of the PRC is from the six nationwide population census, population of Taipei,China is from Wikipedia. ⁴
	Online transaction indicator (0.4)	Average transaction volume = transaction volume of online retailers/population	Transaction volume of online retailers is the total volume of all online retailers on the platform of Taobao.com and Tmall.com by the end of November 2014.
Online consumption indicator (0.5)	Online consumer density indicator (0.6)	Online consumer density = Number of online consumer/population	Number of online consumers is the total number of consumers that purchase at least 1 time on Taobao.com or Tmall.com during January 2014 and November 2014.
	Per capita online consumption indicator (0.4)	Per capita online consumption = online consumption/population	Online consumption is the total consumption volume of all consumers on Taobao.com and Tmall.com during January 2014 and November 2014.

Our data on household entrepreneurship come from the China Household Finance Survey (CHFS) of 2013 and 2015. We use data at both the household level and the individual level. CHFS is a nationwide biennial survey conducted by Southwestern University of Finance and Economics since 2011, and has already completed four rounds of surveys. Three stages of stratification and a proportional-to-population-size sampling method are employed so as to ensure that these data are nationally representative. In 2013, the second round of survey was conducted on more than 28,000 households distributed in around 600 communities of 260 counties in 29 provinces excluding Tibet Autonomous Region; Xinjiang; Hong Kong, China; Macau, China; and Taipei,China. The third round of survey was conducted in 2015, and the sample size was increased to more than 37,000 households distributed in 1,000 communities of 350 counties in 29 provinces excluding Tibet Autonomous Region; Xinjiang; Hong Kong, China; Macau; and Taipei,China. Among all the households surveyed in 2015, more than 21,000 households were follow-up samples, which provided a good panel data for this research.

This paper defines entrepreneurship based on whether an interviewee reports that he/she ran any business during the survey year. We further restrict the sample to people who are aged between 18 and 65 and reported non-missing values on business ownership. At the same time, we delete from the sample those whose entrepreneurship

⁴ Wikipedia. Demographics of Taipei,China.

is in the form of “online business,”⁵ since this research focuses on the impact of e-commerce development on physical business entities. Finally, 24,539 households distributed in 29 provinces and 332 counties have been selected for our sample. The self-reported business run by households might have been operating for a long time before they were surveyed. This makes it difficult to assess the real impacts of e-commerce development on business entities. Meanwhile, e-commerce development not only creates lots of entrepreneurship opportunities, but also brings great challenges to incumbent entities. Therefore, it is also meaningful to explore the effect of e-commerce development on households’ exit from entrepreneurship. The follow-up samples of 2013 and 2015 CHFS data allow us to identify whether a household is a new entrepreneur and whether a household has closed its business. A household is classified as entry into entrepreneurship (i.e. new entrepreneur) if it reported having no business entity in 2013 but having at least one in 2015. Similarly, a household is regarded as having exited entrepreneurship if it reported having a business entity in 2013 but having already closed it when surveyed in 2015.

Figure 1 provides a visual correlation between e-commerce development and entrepreneurship, with each gray dot representing a county. It shows a positive correlation between a county’s average enrollment rate of entrepreneurship and its e-commerce development.

Figure 1: E-commerce Development and County-level Average Enrollment Rate of Entrepreneurship

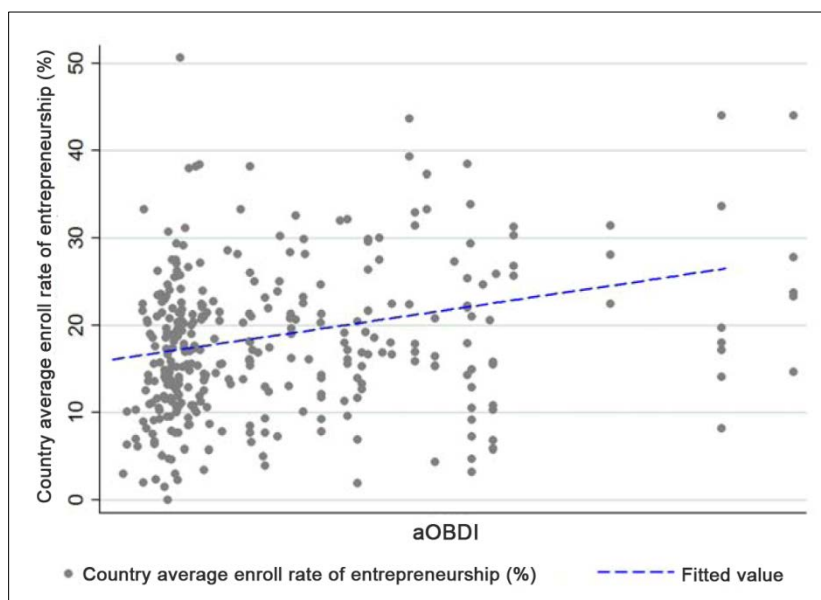


Table 2 reports the summary statistics of key variables. In 2015, about 18.2% of households reported owning business entities. The mean value of aOBDI is 4.75 with a standard deviation of 5.08, indicating large variations of e-commerce development across the PRC. Of the households that did not own any business entities in 2013, 8.78% reported having their own businesses in 2015. At the same time, 31.58% of households having business entities in 2013 reported that they no longer had

⁵ Limited by data, this paper does not exclude SMEs that run businesses as physical entities but have online platforms for customer experience.

any business in operation when surveyed in 2015, suggesting that the exit rate of household entrepreneurship is very high in the PRC.

Table 2: Summary Statistics

Variable	Observations	Mean	SD	Min	Max
aOBDI	24,539	4.7548	5.0838	0	24.2480
Entrepreneurship	24,539	0.1815	0.3854	0	1
Age	24,539	47.9400	10.9494	18	65
Schooling year	24,539	9.7440	3.8867	0	19
Married	24,539	0.8095	0.3927	0	1
Male	24,539	0.7643	0.4244	0	1
Own a house	24,539	0.9157	0.2779	0	1
Family size	24,539	3.4923	1.5422	1	20
Risk lover	24,539	0.1044	0.3058	0	1
Risk averse	24,539	0.6257	0.4839	0	1
Number of communist party members	24,539	0.2314	0.4893	0	3
Number of household member who work	24,539	2.1710	1.1835	0	12
Rural area	24,539	0.3092	0.4622	0	1
Log(non-business income) (unit: RMB)	24,539	9.2860	3.3379	0	16.7214
Entry	13,501	0.0878	0.2831	0	1
Exit	2,530	0.3158	0.4649	0	1
Firm age (unit: year)	3,550	9.0450	7.9267	0	52
Log(business initial investment) (unit: RMB)	3,550	9.9451	2.7244	0	20.7233

Table 3 compares the entrepreneurship activities among counties with different levels of e-commerce development. We find that counties with higher levels of e-commerce development tend to show higher levels of entrepreneurship and higher entry rates of new businesses, but lower exit rates of incumbent businesses.

Table 3: Comparison of Entrepreneurship Activities among Counties with Different Levels of E-commerce Development

	Group 1 (Low)	Group 2 (Medium)	Group 3 (High)
Entrepreneurship	0.1591	0.1800	0.2060
Entry	0.0685	0.0729	0.0782
Exit	0.3471	0.3332	0.3165

3.2 Empirical Method

To test the relationship between e-commerce and entrepreneurship, we first run the following Probit regression:

$$\Pr(\text{Entrepreneurship}_i = 1) = G(\beta_0 + \beta_1 aOBDI_c + \beta_2 X_i) \quad (1)$$

where $aOBDI_c$ is the online business development index of county c , the variable of our main interest. X_i represents the control variables. At the individual level we control for age, age square, marital status, schooling years, gender, and risk attitude. At the household level we control for family size, community dummy, number of household members who work, and household non-business income. We also control province

dummies in the regression. The Online business index takes its value in 2014, and other variables take their values in 2015. In this paper, we group the sample by county, and hence all households in the same county face the same level of e-commerce development. To correct the potential estimation bias, we cluster the residual term ε at the county level to get a robust standard error.

To test the entry effect of e-commerce on entrepreneurship, we estimate the following Probit model:

$$\Pr(\text{Entry}_i = 1) = G(\beta_0 + \beta_1 aOBDI_c + \beta_2 X_i) \quad (2)$$

where *Entry* is a dummy variable indicating whether a household has a new startup and other variables are the same as Model (1). Note that the sample used in Model (3) is households that were followed up in 2015 and reported having no business operation in 2013. We use two models to test the exit effect of e-commerce development on entrepreneurship.

$$\Pr(\text{Exit}_i = 1) = G(\beta_0 + \beta_1 aOBDI_c + \gamma X_i) \quad (3)$$

In Probit Model (3), *Exit* represents whether a household reports having already closed its business in 2015. X_1 represents control variables including all the control variables of X , the age of business entity, and the logarithm of initial investment of business. The sample used in this regression is households that were followed up in 2015 and reported having business operation in 2013 but closed in 2015. With the startup year of household businesses reported in CHFS data, we calculate the duration of household entrepreneurship by deducting the survey month in 2015 with its starting time. For the households that did not exit the entrepreneurship market, the duration of entrepreneurship is regarded as infinite. We run the Cox hazard model below:

$$\varphi(t_i|X_i) = \varphi_0(t_i) \exp(\beta_0 + \beta_1 aOBDI_c + \delta X_i) \quad (4)$$

where $\varphi_0(t_i)$ is the duration of household entrepreneurship. X_i represents control variables, which include all the control variables of X_i and the logarithm of initial business investment.

After estimating the linkage of e-commerce development with entrepreneurship, entry and exit of family business, we move forward to investigate the effect of e-commerce development on the motivation and industry shift of entrepreneurship. We employ the following Probit estimation to assess how local e-commerce development changes the entrepreneurial motivation of households:

$$\Pr(\text{Opportunity_driven}_i = 1) = G(\beta_0 + \beta_1 aOBDI_c + \gamma X_i) \quad (5)$$

where *Opportunity_driven* is a dummy variable indicating whether a household initiates a startup business because of opportunity, rather than survival needs. A person is classified as opportunity-driven entrepreneur if his or her reason of starting business is to be a boss, earn more, and be more flexible.

We employ the multinomial logistic model to study the effect of e-commerce development on industry structure of entrepreneurship. We classify the sectors in which households choose to run their businesses into five categories: (1) industrial sector, including manufacturing, construction, mining, production and providing for power, heat, gas, and water; (2) information and transportation service sector, including software information services, postal services, information transmission, transportation,

and warehousing; (3) wholesale sector; (4) living services sector, including retail, accommodation, and catering; and (5) other service sectors, including real estate, property management, leasing, business services, and others. The multinomial logistic model is shown below:

$$\text{Ln} \left[\frac{P(\text{Industry}_i=j|X_i)}{P(\text{Industry}_i=J|X_i)} \right] = \beta_0 + \beta_1 aOBDI_c + \gamma X_i + \epsilon_i, j = 1,2,3,4,5 \quad (6)$$

where $P(\text{Industry} = j)$ indicates households that choose to start their business operation in industry j . J is the reference group, indicating households that do not engage in business operation. Thus, we have the following 5 logit regression models:

$$\begin{aligned} \text{Ln} \left[\frac{P(\text{Industry}_i = 1|X_i)}{P(\text{Industry}_i = J|X_i)} \right] &= \beta_0 + \beta_1 aOBDI_c + \gamma X_i + \epsilon_i \\ \text{Ln} \left[\frac{P(\text{Industry}_i = 2|X_i)}{P(\text{Industry}_i = J|X_i)} \right] &= \beta_0 + \beta_1 aOBDI_c + \gamma X_i + \epsilon_i \\ \text{Ln} \left[\frac{P(\text{Industry}_i=2|X_i)}{P(\text{Industry}_i=J|X_i)} \right] &= \beta_0 + \beta_1 aOBDI_c + \gamma X_i + \epsilon_i \quad (7) \\ \text{Ln} \left[\frac{P(\text{Industry}_i = 4|X_i)}{P(\text{Industry}_i = J|X_i)} \right] &= \beta_0 + \beta_1 aOBDI_c + \gamma X_i + \epsilon_i \\ \text{Ln} \left[\frac{P(\text{Industry}_i = 5|X_i)}{P(\text{Industry}_i = J|X_i)} \right] &= \beta_0 + \beta_1 aOBDI_c + \gamma X_i + \epsilon_i \end{aligned}$$

4. EMPIRICAL RESULTS

4.1 Baseline Result

In this subsection, we investigate how e-commerce prosperity affects local entrepreneurship, entry of new startups, exit of incumbent businesses, and the motivation and sectoral choices of entrepreneurship.

Table 4 presents estimation results of Model (1) reflecting the impact of e-commerce development on household entrepreneurship. Column (1) shows that the marginal effect of e-commerce development on households' entrepreneurship is significantly positive at the significance level of 1%. This suggests that, the higher the level of e-commerce development in the county a household is living in, the more likely that this household will own a business entity. E-commerce development in counties not only revitalizes the local economy but also enhances consumption demand and changes the consumption habits of residents, encouraging households to engage in business operation. Column (2) and (3) of Table 3 report the estimation results for urban and rural samples. The marginal effect of e-commerce development on entrepreneurship is 0.0027 for urban households, and 0.0095 for rural households. The significance test of difference shows that the effect of e-commerce development on the propensity of business operation is more noteworthy in rural areas than in urban areas.

Among control variables, urban households are more likely to engage in business operation than their rural counterparts. The propensity for a household to own a business entity initially increases with age and then decreases, indicating that middle-aged households tend to have higher levels of entrepreneurship. Education level does not have any significant influence on households' propensity for business ownership, suggesting that education in the PRC does not prepare well for entrepreneurship. Households with male and married members are more likely to run a business. The larger the size of a household is, the more labor forces it has, and hence the more likely it would run a business. Consistent with our expectation, risk-seeking households are more likely to run their own businesses than risk-averse households.

Table 4: E-commerce and Entrepreneurship: Probit Models

	Entrepreneurship		
	(1)	(2)	(3)
	Nationwide	Urban	Rural
aOEDI	0.0032*** (0.0012)	0.0027** (0.0013)	0.0095*** (0.0024)
Age	0.0048** (0.0019)	0.0036 (0.0023)	0.0055* (0.0033)
Age sq.	-0.0001*** (0.0000)	-0.0001*** (0.0000)	-0.0001** (0.0000)
Schooling year	0.0002 (0.0009)	-0.0011 (0.0011)	0.0060*** (0.0013)
Married	0.0243*** (0.0072)	0.0361*** (0.0085)	-0.0148 (0.0115)
Male	0.0218*** (0.0056)	0.0231*** (0.0064)	-0.0057 (0.0129)
Own house	0.0385*** (0.0089)	0.0484*** (0.0098)	0.0032 (0.0274)
Family size	0.0112*** (0.0026)	0.0169*** (0.0033)	0.0074** (0.0033)
Risk lover	0.0220*** (0.0080)	0.0231** (0.0092)	0.0260* (0.0143)
Risk averse	-0.0304*** (0.0056)	-0.0441*** (0.0070)	-0.0099 (0.0086)
Number of communist party members	-0.0277*** (0.0061)	-0.0440*** (0.0072)	0.0440*** (0.0096)
Number of household member who work	0.0363*** (0.0033)	0.0406*** (0.0045)	0.0171*** (0.0041)
Rural area	-0.1247*** (0.0090)		
Log(non-business income)	-0.0158*** (0.0008)	-0.0212*** (0.0010)	-0.0040*** (0.0011)
Observations	24,539	16,951	7,588
F-statistics of coefficient difference of aOBEI (p-value)			25.30 (0.00)

Note: The marginal effect of the Probit model is reported and standard errors clustering at the county level are reported in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively. Province dummies are controlled in all regressions.

Table 5: E-commerce and Entry of Entrepreneurship: Probit Models

	(1)	(2)	(3)
	Entry		
	Nationwide	Urban	Rural
aOEDI	0.0024*** (0.0009)	0.0015 (0.0011)	0.0048*** (0.0014)
Age	-0.0053*** (0.0019)	-0.0070*** (0.0026)	-0.0007 (0.0032)
Age sq.	0.0000* (0.0000)	0.0000* (0.0000)	-0.0000 (0.0000)
Schooling year	-0.0012 (0.0008)	-0.0020** (0.0010)	0.0013 (0.0011)
Married	0.0083 (0.0087)	0.0099 (0.0109)	0.0089 (0.0135)
Male	0.0092 (0.0062)	0.0103 (0.0073)	-0.0049 (0.0127)
Own house	0.0133 (0.0093)	0.0192* (0.0109)	0.0136 (0.0238)
Family size	0.0055** (0.0022)	0.0086*** (0.0030)	0.0048* (0.0029)
Risk lover	0.0113 (0.0082)	0.0153 (0.0104)	0.0049 (0.0143)
Risk averse	-0.0235*** (0.0055)	-0.0348*** (0.0074)	-0.0099 (0.0077)
Number of communist party members	-0.0114** (0.0056)	-0.0249*** (0.0068)	0.0327*** (0.0090)
Number of household member who work	0.0169*** (0.0029)	0.0177*** (0.0043)	0.0092** (0.0036)
Rural area	-0.0562*** (0.0069)		
Log(non-business income)	-0.0071*** (0.0008)	-0.0114*** (0.0010)	-0.0014 (0.0011)
Observations	13,501	8,349	5,152
F-statistics of coefficient difference of <i>aOBEI</i> (p-value)			15.62 (0.00)

Note: The marginal effect of the Probit model is reported and standard errors clustering at the county level are reported in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively. Province dummies are controlled in all regressions. The nationwide sample is households that did not enroll in business operation in 2013 and are followed up in 2015.

In a word, e-commerce development significantly increases the propensity for households to own a business entity. The current debate argues that, although e-commerce development might encourage the entry of entrepreneurship, it could crowd out the incumbent business, for example retail stores. To provide evidence on this debate, we further investigate the net impact of e-commerce development on the entry and exit of household business entities. Table 5 reports corresponding regression results on the households that were surveyed in both 2013 and 2015. Households that did not have any business entity in 2013 but already had at least one in 2015 are

defined as *entry*. The Probit estimation result reported in Column (1) shows that the marginal effect of e-commerce development on startups is significantly positive at the level of 1%. The possibility of startups will rise by 0.0122 with one standard deviation of increase in the e-commerce development index. Compared with the average percentage of startups in the total sample (0.0878), this magnitude is economically significant. In other words, e-commerce plays a sizable role in encouraging households to initiate startup businesses.

As a new business model with lower operation costs, e-commerce development may bring challenges to incumbent entrepreneurs. In Table 6, we test whether e-commerce development leads to the exit of incumbent businesses. The Probit estimation shown in Column (1) suggests that e-commerce development significantly decreases the exit of existing business entities. With one standard deviation of the increase in *aOEDI*, the possibility of the exit of local business entities declines by 0.1093. Compared with the average exit rate of 0.3158 in the whole sample, the decreasing effect of e-commerce development on the exit of entity entrepreneurs is economically meaningful. Columns (2) and (3) report the results of the Cox model. Column (2) shows the regression coefficient of each control variable in the equation of exit risk, and Column (3) presents the proportional hazard, which is the ratio of exit risk caused by each control variable deviating from basic exit risk. When the value of proportional hazard is greater than 1, this variable increases the exit risk of incumbent entrepreneurs. In contrast, when the value of proportional hazard is less than 1, this variable reduces the exit risk of incumbent entities. We find that the coefficient of *aOEDI* is significantly negative, and the ratio of exit risk caused by *aOEDI* deviating from basic exit risk is 0.9690 (less than 1), suggesting that e-commerce development significantly reduces the exit risk of incumbent entities and further verifies the decreasing effect of e-commerce development on the exit of incumbent business. Overall, our empirical evidences show that the “crowding-out effect” of e-commerce on physical business entities does not exist in the PRC.

In Table 7, we further explore how e-commerce affects the motivation of household entrepreneurship. We find that households living in counties with higher level of e-commerce development are more likely to start their own business for reasons of being a boss, earning more, and being more flexible, i.e. they are considered opportunity-driven entrepreneurs, rather than for survival needs. Columns (2) and (3) show that e-commerce development significantly increases the possibility for both urban households and rural households to be opportunity-driven entrepreneurs. However, the significance test of difference (with a p-value of 0.9712) suggests that the impact of e-commerce development on entrepreneurial motivation is not significantly different between urban households and rural households. In a word, e-commerce development not only enhances the entrepreneurial activity of local residents, but also makes it possible for households to participate proactively in business operation because of discovering new business opportunities.

Table 6: E-commerce and Exit of Incumbent Entrepreneurs

	(1)	(2)	(3)
	Probit Model	Cox Risk Model	
	Exit	Coefficient	Proportional Hazard
aOEDI	-0.0215*** (0.0074)	-0.0315*** (0.0115)	0.9690*** (0.0110)
Age	-0.0774*** (0.0214)	-0.1423*** (0.0270)	0.8674*** (0.0234)
Age sq.	0.0010*** (0.0002)	0.0014*** (0.0003)	1.0014*** (0.0003)
Schooling year	0.0109 (0.0092)	-0.0070 (0.0133)	0.9931 (0.0132)
Married	-0.2015* (0.1054)	-0.1757 (0.1354)	0.8388 (0.1136)
Male	-0.0697 (0.0675)	-0.1078 (0.0976)	0.8978 (0.0877)
Own house	-0.0812 (0.0889)	-0.2839** (0.1322)	0.7528** (0.0995)
Family size	0.0091 (0.0251)	-0.0013 (0.0342)	0.9987 (0.0342)
Risk lover	-0.0122 (0.0850)	0.0526 (0.1178)	1.0540 (0.1242)
Risk averse	0.0175 (0.0655)	-0.0221 (0.0872)	0.9781 (0.0853)
Number of communist party members	-0.0060 (0.0660)	0.0503 (0.0890)	1.0516 (0.0936)
Number of household member who work	-0.0424 (0.0376)	0.0014 (0.0434)	1.0014 (0.0434)
Rural area	0.3168*** (0.0668)	0.3484*** (0.0879)	1.4168*** (0.1246)
Log(non-business income)	0.0237** (0.0094)	0.0282** (0.0142)	1.0286** (0.0145)
Firm age	-0.0165*** (0.0044)		
Log(initial investment)	0.0150 (0.0196)	0.1198*** (0.0214)	1.1272*** (0.0242)
Observations	2,530	2,429	2,429

Note: The marginal effect of the Probit model is reported and standard errors clustering at the county level are reported in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively. Province dummies are controlled in all regressions. The nationwide sample is households that enrolled in business operation in 2013 and are followed up in 2015. A total of 101 observations were dropped due to collinearity in the Cox model.

Table 7: E-commerce and Entrepreneurial Motivation: Probit Models

	(1)	(2)	(3)
	Opportunity-driven Entrepreneurship		
	Nationwide	Urban	Rural
aOEDI	0.0052*** (0.0018)	0.0044** (0.0018)	0.0092* (0.0052)
Age	-0.0065 (0.0050)	-0.0054 (0.0055)	0.0104 (0.0142)
Age sq.	0.0000 (0.0001)	-0.0000 (0.0001)	-0.0001 (0.0001)
Schooling year	0.0085*** (0.0023)	0.0070*** (0.0026)	0.0118** (0.0057)
Married	0.0292 (0.0188)	0.0263 (0.0215)	0.0553 (0.0450)
Male	-0.0201 (0.0174)	-0.0209 (0.0184)	-0.0024 (0.0525)
Own house	0.0524** (0.0213)	0.0425* (0.0221)	0.1835* (0.0950)
Family size	-0.0057 (0.0060)	-0.0112 (0.0072)	0.0153 (0.0129)
Risk lover	0.0232 (0.0216)	0.0106 (0.0232)	0.0794 (0.0577)
Risk averse	-0.0198 (0.0154)	-0.0364** (0.0175)	0.0528 (0.0357)
Number of communist party members	-0.0140 (0.0163)	-0.0105 (0.0181)	-0.0239 (0.0382)
Number of household member who work	0.0107 (0.0082)	0.0154 (0.0101)	-0.0140 (0.0172)
Rural area	0.0150 (0.0170)		
Log(non-business income)	0.0035** (0.0018)	0.0044** (0.0020)	0.0002 (0.0041)
Observations	4,453	3,529	924
F-statistics of coefficient difference of <i>aOBEI</i> (p-value)			0.00 (0.9712)

Note: The marginal effect of the Probit model is reported and standard errors clustering at the county level are reported in parentheses. ***, **, and * indicate significance level of 1%, 5%, and 10%, respectively. Province dummies are controlled in all regressions. The sample used in this table is households that enrolled in business operation in 2015. A household is classified as opportunity-driven entrepreneurship if the reason for starting a business wants to be a boss, to earn more, and to enjoy more flexibility.

E-commerce development needs offline supports including order receiving, settlement, warehousing, distribution, installation, and after-sales service, among others. The prosperity of e-commerce can create entrepreneurial opportunities closely related to e-commerce platforms, such as wholesale, information technology service, logistics and transportation, and so on. As a result, e-commerce development may lead to changes in the sector selection of household entrepreneurship. We employ the

multivariate Logit model⁶ to test this effect. The regression results reported in Table 8 show that the impact of e-commerce development on entrepreneurship is significantly positive for the industrial sector, the information and transportation service sectors, and the wholesale sector, but is significantly negative for the living services sector. This suggests that e-commerce prosperity increases the likelihood for local residents to start business operation in the industrial and wholesale sectors, but decreases the possibility for residents to start business operation in the living services sector. In other words, e-commerce development results in changes in the sector choices of entrepreneurship. Business operations in retail, accommodation, catering, and other low-value-added sectors decline, while business operation in the industrial sector and the wholesale, transportation, and information services sectors serving for e-commerce development will boom.

Table 8: E-commerce and Sectoral Choice of Entrepreneurship

	(1)	(2)	(3)	(4)	(5)
	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
aOEDI	0.0011*** (0.0004)	0.0001 (0.0003)	0.0004* (0.0002)	-0.0020*** (0.0007)	-0.0004 (0.0005)
Age	0.0031*** (0.0008)	0.0010* (0.0006)	-0.0002 (0.0004)	0.0001 (0.0014)	0.0015* (0.0008)
Age sq.	-0.0000*** (0.0000)	-0.0000*** (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000** (0.0000)
Schooling year	-0.0001 (0.0003)	-0.0002 (0.0003)	-0.0001 (0.0002)	-0.0009 (0.0006)	0.0010*** (0.0004)
Married	0.0043 (0.0030)	0.0013 (0.0025)	0.0039** (0.0018)	0.0110** (0.0056)	0.0029 (0.0029)
Male	0.0040* (0.0023)	0.0048** (0.0023)	0.0018 (0.0017)	0.0051 (0.0044)	0.0018 (0.0024)
Own house	0.0077* (0.0042)	0.0030 (0.0033)	0.0061** (0.0030)	0.0077 (0.0072)	0.0027 (0.0042)
Family size	0.0023** (0.0010)	0.0020*** (0.0007)	0.0003 (0.0006)	0.0053*** (0.0019)	-0.0003 (0.0011)
Risk lover	-0.0000 (0.0030)	0.0006 (0.0029)	0.0002 (0.0019)	0.0102 (0.0064)	0.0059* (0.0033)
Risk averse	-0.0066*** (0.0021)	-0.0052** (0.0020)	-0.0055*** (0.0017)	-0.0055 (0.0043)	-0.0004 (0.0023)
Number of communist party members	-0.0042* (0.0025)	-0.0053** (0.0024)	-0.0021 (0.0015)	-0.0129*** (0.0044)	-0.0093*** (0.0029)
Number of household member who work	0.0064*** (0.0013)	0.0010 (0.0010)	0.0016* (0.0009)	0.0174*** (0.0024)	0.0066*** (0.0013)
Rural area	-0.0141*** (0.0034)	-0.0091*** (0.0024)	-0.0070*** (0.0022)	-0.0803*** (0.0066)	-0.0179*** (0.0030)
Log(non-business income)	-0.0023*** (0.0002)	-0.0009*** (0.0002)	-0.0009*** (0.0002)	-0.0088*** (0.0006)	-0.0017*** (0.0003)
Observations	24,146	24,146	24,146	24,146	24,146

Note: The marginal effect of the multinomial logit model is reported and standard errors clustering at the county level are reported in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively. Province dummies are controlled in all regressions. The sample used in this table is all households in 2015. The baseline group is households that did not enroll in business operation in 2015. Sector 1: industrial sector; Sector 2: information and transportation service sector; Sector 3: wholesale sector; Sector 4: living services sector; Sector 5: other service sectors.

⁶ The estimated result of the multivariate Probit model does not converge, so there is the multivariate Logit model.

4.2 Working Mechanism of E-commerce

This subsection explores the working mechanism through which e-commerce spurs entrepreneurship. We argue that e-commerce encourages household entrepreneurship by not only alleviating the financial constraints facing new startups but also moderating the household reliance on social networks for marketing.

Financial constraint is a key factor that restricts households from participating in business operations (Evans and Jovanovic 1989; Cagetti and De Nardi 2006). Some literature links household or individual wealth to the propensity for entrepreneurship. Hurst and Lusardi (2004) show that a positive correlation between wealth and propensity to start one's own business exists only for extremely wealthy households and that borrowing constraints may not affect the entrepreneurial activities of less wealthy households. Fairlie and Krashinsky (2012) found that the probability of being self-employed increases with wealth for both currently unemployed and employed households. In recent years, more and more attention has been devoted to studying the role of housing wealth in promoting entrepreneurship (Adelino, Schoar, and Severino 2015).

Following Hurst and Lusardi (2004), this paper uses net assets to reflect the financial constraint for a household. The larger the net assets are, the less is the financial constraint facing a household. To test how e-commerce changes the financial constraint for household entrepreneurship, we trisect the range of net household assets and then categorize all our samples into three groups of households with low, medium, and high value of net assets, respectively. We then introduce the interaction term between e-commerce development and different asset groups to assess the impacts of e-commerce development on the entrepreneurship of households with different assets. Using households with high asset levels as a reference group, the estimation results presented in Column (1) of Table 9 show that the possibility for a household to own a physical business entity is positively related to the amount of assets it has. Compared with households with high net assets, the possibility for a household with a low asset level to participate in business operation is the lowest, followed by the households with medium assets. This proves that net assets are key factors deciding household entrepreneurship. The significantly positive coefficients on the interaction term between the online business indicator and asset group dummies indicate that e-commerce effectively alleviates the financial constraints on household entrepreneurship. In addition, the coefficient on the interaction term between the online business index and the low-asset group is bigger than that on the interaction term between the online business index and the medium-asset group. This suggests that e-commerce development plays a more phenomenal role in moderating the financial constraints facing households with low assets in setting up their own business entities.

Social networks are another key factor affecting the startup of physical SMEs (Greve and Salaff 2003). Following Cai et al. (2018), we use the sum of cash and non-cash expenses in holidays, weddings, and funerals as a proxy for social network, and then trisect all our samples into three groups of households with low, medium, and high values of social network, respectively. Using households with high social network value as the reference group, the estimation result presented in Column (2) of Table 9 shows that low social network value is an important constraint on household entrepreneurship. Facing such a constraint, households with the lowest social network values have the lowest probability of owning physical business entities. However, the negative coefficients on the interaction term between the online business index and the dummy of social network groups imply that e-commerce development is effective in moderating the reliance of households on social networks and greatly enhances the probability for

households with limited social networks to set up their own businesses. One possible explanation is that e-commerce development broadens channels to obtain information and funds.

Table 9: Working Mechanism of E-commerce on Entrepreneurship

	(1) (2)	
	Entrepreneurship	
aOEDI	−0.0001 (0.0014)	0.0021* (0.0012)
Low asset group	−0.1972*** (0.0101)	
Medium asset group	−0.0973*** (0.0092)	
aOEDI * Low asset group	0.0053*** (0.0010)	
aOEDI * Medium asset group	0.0034** (0.0014)	
Low social interaction group		−0.1105*** (0.0092)
Medium social interaction group		−0.0580*** (0.0074)
aOEDI * Low social interaction group		0.0028** (0.0011)
aOEDI * Medium social interaction group		0.0002 (0.0010)
Control variables		Controlled
Observations	24,539	23,654
Observations	24,146 24,146	24,146 24,146

Note: The marginal effect of the multinomial logit model is reported and standard errors clustering at the county level are reported in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively. Province dummies are controlled in all regressions, and control variables are the same as Table 1. The sample used in this table is all households in 2015.

4.3 Robustness Check and Endogeneity Concerns

The analysis so far has used the county-level e-commerce development index constructed with big data to measure its impact on household entrepreneurship. As a robustness check, we further employ the provincial e-commerce development index⁷ constructed by several agencies under the guidance of National Development and Reform Commission (NDRC) as another source of official data to investigate the linkage between e-commerce development and entrepreneurship. Columns (1) to (3) in Table 9 show the corresponding regression results. It can be found that the coefficient on the provincial e-commerce development index is still significantly positive at the level of 1%, suggesting the robust role of e-commerce in promoting entrepreneurship.

⁷ The construction method of specific indicators can be found in the *China E-commerce Development Index Report (2014-2015)*; see http://www.ec.com.cn/article/dsyj/dsbg/201605/9690_1.html.

Table 10: Robustness and Endogeneity

	(1)	(2)	(3)	(4)
	Probit Nationwide	Probit Urban	Probit Rural	IV_Probit Nationwide
Tsinghua e-commerce development index	0.0008*** (0.0001)	0.0006*** (0.0002)	0.0012*** (0.0002)	
aOEDI				0.0069*** (0.0018)
Age	0.0039** (0.0017)	0.0032 (0.0020)	0.0042 (0.0034)	0.0058*** (0.0020)
Age sq.	-0.0001*** (0.0000)	-0.0001*** (0.0000)	-0.0001** (0.0000)	-0.0001*** (0.0000)
Schooling year	0.0005 (0.0007)	-0.0008 (0.0009)	0.0059*** (0.0012)	-0.0001 (0.0009)
Married	0.0235*** (0.0065)	0.0345*** (0.0078)	-0.0112 (0.0110)	0.0247*** (0.0071)
Male	0.0210*** (0.0056)	0.0227*** (0.0066)	-0.0055 (0.0124)	0.0235*** (0.0056)
Own house	0.0376*** (0.0086)	0.0471*** (0.0097)	0.0101 (0.0236)	0.0415*** (0.0090)
Family size	0.0117*** (0.0022)	0.0168*** (0.0030)	0.0065** (0.0029)	0.0117*** (0.0026)
Risk lover	0.0240*** (0.0078)	0.0249*** (0.0096)	0.0281** (0.0137)	0.0217*** (0.0080)
Risk averse	-0.0298*** (0.0052)	-0.0434*** (0.0066)	-0.0106 (0.0081)	-0.0288*** (0.0057)
Number of communist party members	-0.0286*** (0.0053)	-0.0442*** (0.0064)	0.0386*** (0.0093)	-0.0269*** (0.0061)
Number of household member who work	0.0336*** (0.0028)	0.0384*** (0.0038)	0.0158*** (0.0039)	0.0358*** (0.0033)
Rural area	-0.1302*** (0.0060)			-0.1199*** (0.0090)
Log(non-business income)	-0.0159*** (0.0006)	-0.0215*** (0.0008)	-0.0039*** (0.0010)	-0.0159*** (0.0008)
Observations	25,835	17,693	8,142	24,539
1st stage F-statistics/t-statistics of instrumental variable				36.1300 (8.5000)
Endogeneity test				11.0700 (0.0009)

Note: The marginal effect of the Probit model is reported and standard errors clustering at the county level are reported in parentheses. ***, **, and * indicate significance levels of 1%, 5%, and 10%, respectively. Province dummies are controlled in all regressions. The sample used in this table is all households in 2015.

Reverse causality between entrepreneurship and local e-commerce development may bias our conclusion. For example, people with higher levels of entrepreneurship are more likely to run their businesses at e-commerce platforms. To address this concern, we adopt the average online business development index of other counties in the same province as an instrumental variable (IV) for the online business development index in a specific county. The online business development of other counties in the same province is highly correlated with the online business development of the district (county), but the level of online business development of other counties could hardly affect entrepreneurship in the county. Column (4) in Table 10 shows the IV estimation results. The first stage estimation generates a t-value of 8.5000 for the instrumental

variable, at the significance level of 1%, and an F-value of 36.1300. Both indicate that our instrumental variable is valid (Stock and Yogo 2005). At the same time, the Durbin-Wu-Hausman (DWH) test significantly rejects the null hypothesis that online business index does not have endogeneity, indicating the necessity of implementing IV estimation. The second stage estimation shows that the marginal effect of the online business index is 0.0069, significantly positive at the level of 1%, confirming the prominent role of e-commerce development in boosting entrepreneurship.

5. CONCLUSION

As a new business model, the importance of e-commerce has received more and more attention. However, our knowledge of its impact on real economic activities is limited. In this paper, we utilize an e-commerce development indicator constructed with big data to gauge the variations of e-commerce development across PRC counties and assess its impact on entrepreneurship in both rural and urban areas. We find that e-commerce significantly spurs entrepreneurship in both urban and rural areas. Its role is even more remarkable in rural areas. Further analysis shows that e-commerce enhances entrepreneurship in two ways. It not only encourages the startup of new businesses but also lowers the exit of incumbent business entities. Moreover, e-commerce development changes the sectoral choices of entrepreneurship. It encourages households to establish physical business entities closely related to e-commerce operations, including wholesale, transportation, and information technology. At the same time, e-commerce lowers entrepreneurship in the sectors with low added value such as retail, lodging, catering and so on. We also explore the mechanism through which e-commerce affects entrepreneurship and find that e-commerce prosperity alleviates the financial constraints facing household entrepreneurship because e-commerce dramatically reduces the transactional and operational cost of business. Furthermore, e-commerce moderates the reliance of household entrepreneurship on social networks because it can easily extend the trade beyond the realm of trust-based network. Given the positive and significant role of e-commerce in boosting entrepreneurship and SMEs, the implications of our analysis are obvious and immediate: the government should encourage the development of e-commerce, integrate it into the local economy, and leverage it to upgrade the industrial structure.

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