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Digital economy and settlement intention of migrants in urban China☆

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ABSTRACT

This paper utilizes data from the China Migrants Dynamic Survey (CMDS) and the digital economy index at the city level to empirically examine the impact of the digital economy on migrants' settlement intention. The results reveal a substantial enhancement in migrants' settlement intention due to the digital economy, and these findings remain robust when considering model misspecification, measurement error, and endogeneity of the digital economy. Furthermore, the digital economy contributes to migrants' settlement intention by fostering entrepreneurial activities and augmenting household income. Additionally, we find a significant and positive effect of the digital economy on the settlement intention of migrants with agricultural hukou, while no significant effect is observed for migrants with non-agricultural hukou. Overall, this study offers novel insights into strategies for promoting urbanization.

1. Introduction

Large-scale urbanization has emerged as a significant catalyst for China's rapid economic progress (Chen & Liu, 2016). The mobility of labor is instrumental in driving China's economic and productivity growth, while simultaneously alleviating poverty among rural dwellers (Liu, Qi, & Cao, 2015). Since the initiation of China's reform and opening-up policy in 1978, a substantial rural population has migrated to urban areas. Moreover, the household registration system underwent reforms in the 1990s, thereby easing institutional barriers to population mobility and further facilitating rural-urban labor migration (Lin & Zhu, 2022; Zhu, Lin, & Ke, 2016). According to the seventh National Census in China, the migrant population reached an astounding 376 million in 2020, constituting 41.6% of the urban populace (National Bureau of Statistics of China, 2020). However, migrants largely find themselves marginalized within cities, posing formidable challenges to the sustainability and stability of China's overall development (Huang & Ren, 2022; Huang & Tao, 2015; Tao, Hui, Wong, & Chen, 2015; Wang & Fan, 2012). A considerable proportion of migrants exist in a semi-urban state, wherein they encounter disparities in access to public services and benefits compared to local residents, hindering their true integration into the urban city (Cao, Li, Ma, & Tao, 2015; Zhu, 2007). In the pursuit of "people-centered urbanization" and the "citizenization of rural migrants," ensuring migrants' equal access to essential public services has become a paramount task for China's urbanization agenda. Consequently, in the contemporary phase of late-intermediate urbanization in China, comprehending migrants' settlement intentions and identifying their pertinent influencing factors hold immense significance for both academic

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research and policymaking endeavors.

Within the existing literature, three prevailing ideas dominate the debate on the factors influencing settlement intentions. The first perspective emphasizes economic incentives, positing that opportunities and income play a decisive role in shaping migrants' settlement intentions (Constant & Massey, 2003; Khraif, 1992; Lin & Zhu, 2016). The second viewpoint underscores the complex mechanism of social integration within Chinese cities, asserting that the inclusiveness of cities stands as the primary factor impacting migrants' residential decisions (Liu et al., 2013, 2017; Wang, Zhang, & Wu, 2015). From a sociological standpoint, the third notion emphasizes the significance of migrants' attachment to their hometowns in the determination of their settlement choices (Constant & Massey, 2003; De Vroome & van Tubergen, 2014; Korinek, Entwisle, & Jampaklay, 2005; Massey, 1987). In recent years, China has witnessed transformations in the economic and social circumstances experienced by migrants. Migrant employment has become more stable, and their duration of residence in destination cities has extended (Duan, Xie, & Lv, 2019; Zhu et al., 2016). Consequently, it becomes paramount to re-examine migrants' settlement intentions and identify the key determinants in light of these evolving dynamics.

With the rapid advancement of information technology, the digital economy has emerged as a driving force behind China's economic and social development, leveraging cloud computing, big data, artificial intelligence, and the Internet (Guo et al., 2023; Ma & Zhu, 2022; Zhu & Chen, 2022). To achieve sustainable development in the digital economy, China aims to promote digital industrialization and industrial digitization while enhancing the seamless integration of digital technologies with the real economy, thus creating internationally competitive digital industrial clusters (State Council of the People's Republic of China, 2021). Significant progress has been made in China's digital economy development in 2021. The scale of the digital economy reached 45.5 trillion yuan, accounting for 39.8% of GDP. The digital economy has demonstrated its influential role in enhancing economic growth and improving residents' well-being across various sectors (Liu, Sierdjan, & Chen, 2022; Zou & Deng, 2022). The digital economy's open, free, and flexible characteristics have stimulated increased activity in China's labor market, attracting talent flows, particularly to cities that benefit from a more developed digital economy such as Beijing, Shanghai, Guangzhou, and Shenzhen. Consequently, these cities become preferred settlement destinations for migrants, contributing to population inflows (Liu et al., 2022; Zou & Deng, 2022). For migrants, who often face disadvantages in cities, the digital economy's extensive reach and wide coverage hold the potential to bring about positive outcomes (Zou & Deng, 2022). Therefore, exploring the relationship between the digital economy and migrants' settlement intention is crucial. It offers empirical evidence and valuable policy insights towards fostering urban settlement among migrants, ultimately promoting inclusivity and social cohesion in Chinese cities.

This study utilizes data from the China Migrants Dynamic Survey (CMDS) and the city-level digital economy index to empirically investigate the impact of the digital economy on migrants' settlement intention. The findings highlight a significant positive effect of the digital economy on migrants' settlement intention, which remains robust even when considering model misspecification, measurement errors, and endogeneity issues associated with the digital economy. Furthermore, the study reveals that the digital economy fosters migrants' willingness to settle by enhancing their entrepreneurial spirit and household income. Additionally, the analysis demonstrates a significant and positive influence of the digital economy on the settlement intention of rural migrants, while no significant impact is observed among non-agricultural migrants. [1]

This paper makes a valuable contribution to the existing literature by empirically examining the impact of the digital economy on migrants' settlement intentions in cities. The contribution can be highlighted in three key aspects. First, while previous research has explored several individual-level outcomes resulting from the digital economy (Leng, 2022; Qi & Liu, 2020; Zhang, Wan, Zhang, & He, 2019; Zou & Deng, 2022), scant attention has been given to migrants' settlement intentions. To the best knowledge of the authors, this study represents the first attempt to investigate how the digital economy influences migrants' settlement intentions. Second, building upon the methodology proposed by Zhao, Zhang, and Liang (2020), this study constructs a more comprehensive proxy variable for the digital economy. Prior studies have predominantly employed the digital financial inclusion index as a measure of the digital economy (Lee, Lou, & Wang, 2023; Ma & Hu, 2022; Niu, Jin, Wang, & Zhou, 2022), although it encompasses only one dimension of the digital economy. In contrast, this study constructs a digital economy index that considers multiple dimensions, such as Internet penetration rate, employment dynamics, output indicators, mobile phone penetration rate, and digital financial inclusion. Third, this paper investigates potential explanations for the relationship between the digital economy and migrants' settlement intentions through the lens of entrepreneurship and income. This not only enriches our understanding of the mechanisms underlying the social consequences of the digital economy but also provides novel insights for local governments seeking to attract labor forces.

The remainder of this article is structured as follows: Section 2 provides an overview of the existing literature on the relationship between the digital economy and migrants' settlement intentions in cities. Section 3 outlines the data sources, variables, and methodological approach employed in this study. In Section 4, we present the key empirical findings. Section 5 presents the results of various robustness checks conducted to validate our findings. Moving forward, Section 6 offers a discussion on potential explanations

[1] The hukou system in China has been in place since 1958 and involves the classification of residents into agricultural hukou and non-agricultural hukou categories based on their permanent residency type within the country. Agricultural hukou residents are primarily engaged in subsistence farming, while those with non-agricultural hukou receive distributed resources from the state. The hukou system has led to the establishment of different labor employment and social security frameworks that are linked to an individual's residential registration status. Consequently, individuals with agricultural hukou tend to experience lower income levels and have a lower propensity for consumption compared to those with non-agricultural hukou. It is important to note that migrants who possess agricultural hukou often represent disadvantaged groups, as they are frequently marginalized from local public services and social benefits. These disadvantages can have a significant impact on their socioeconomic well-being and integration into urban society.

for the observed relationship between the digital economy and migrants' settlement intentions, along with an analysis of the heterogeneity effect among migrants with different hukou types. Finally, Section 7 concludes this paper by summarizing the main findings and highlighting their implications for theory and practice.

2. Literature review

The determinants of migrants' settlement intentions have received considerable attention in the literature (Constant & Massey, 2003; Dustmann & Weiss, 2007; Hu, Xu, & Chen, 2011; Huang, Liu, Xue, Li, & Shi, 2018; Jensen & Pedersen, 2007). Migrants typically make settlement decisions based on economic returns, living costs, and the inclusiveness of cities (Roback, 1982). Scholars often conceptualize migration decisions as a process of self-value maximization (Constant & Massey, 2003; Khraif, 1992; Massey & Akresh, 2006). Migrants with higher levels of education, better occupations, and higher incomes tend to be more economically integrated into destination cities, increasing their willingness to settle down (Jensen & Pedersen, 2007; Khraif, 1992; Lin & Zhu, 2016). Moreover, a longer duration of residence in a destination city facilitates the accumulation of human capital and boosts settlement intentions (Chen & Liu, 2016). Scholars have also explored the impact of city inclusiveness on migrants' settlement intentions. Previous research suggests that public services such as medical care and education (Chan & Zhang, 1999; Lin & Zhu, 2022; Yang, 1993) and subsidized housing policies (Huang & Ren, 2022) enhance migrants' settlement intentions. The household registration system, which determines a city's inclusiveness, has been identified as a moderating factor (Chan & Zhang, 1999; Solinger, 1999; Zhu, 2007; Zhu & Chen, 2022). Additionally, environmental pollution (Jia & Chen, 2021; Spencer & Walsh, 2008) and housing prices (Zhou & Hui, 2022) exert an influence on migrants' settlement intentions. Zhang, He, and Ma (2017) found that housing prices have both attracting and hindering effects on settlement intentions, characterized by an inverted U-shaped relationship. Social ties also play a significant role in migrants' settlement intentions. Migrants who maintain strong connections with their hometowns often express less desire to settle down in the destination city and prefer to return home (Constant & Massey, 2003; Korinek et al., 2005; Reyes, 2001). Conversely, migrants who actively establish social networks within the destination city tend to exhibit stronger intentions to settle down (Gu, Liu, & Shen, 2020; Huang et al., 2018). Factors such as having a family or children in the destination city, maintaining positive social relationships, and engaging in frequent interactions with locals contribute to migrants' settlement intentions (De Vroome & van Tubergen, 2014; Haug, 2008; Massey, 1987).

The digital economy, characterized by data resources as the key factors of production, enables the agglomeration, optimization, and distribution of production factors through digital technology (Guo et al., 2023; Zhu & Chen, 2022). It has emerged as a crucial driving force behind China's sustainable economic and social transformation (Ma & Zhu, 2022; Wang et al., 2022). The digital economy facilitates high-quality economic development by fostering entrepreneurship (Sun & You, 2023), spurring scientific and technological innovation (Liu et al., 2022), enhancing total factor productivity (Chen, Yang, & Li, 2022; Gu et al., 2023), and promoting industrial structure upgrading (Wu & Yang, 2022). Moreover, the widespread adoption of digital technology significantly boosts residents' consumption enthusiasm and improves their living standards (He, Li, & Wang, 2022; Xue, Tang, Wu, Liu, & Hao, 2022). By overcoming regional and spatial boundaries, the digital economy also promotes collaborative development among regions (Wu & Feng, 2022). However, measuring the digital economy presents challenges due to its broad scope and the fuzzy boundary between the digital and non-digital sectors. Scholars have employed the digital financial inclusion index to explore the economic impact of digital inclusive finance, focusing on aspects such as urban-rural income inequality, entrepreneurial activities, resident income, and consumption (Lee et al., 2023; Ma & Hu, 2022; Niu et al., 2022). These studies demonstrate the positive role played by the digital economy in increasing income and consumption levels (He et al., 2022; Xue et al., 2022), improving employment quality (Lu, Xiao, & Wang, 2023), and driving inclusive growth (Sun & Tang, 2022). However, due to limitations in measuring the digital economy using the digital inclusive finance index, Zhao et al. (2020) propose a proxy variable for the digital economy that incorporates Internet development and digital financial inclusion. This study contributes to the literature by enriching the measurement of the digital economy at the city level.

The positive impact of the digital economy on migrants' settlement intentions can be attributed to two plausible reasons. First, the digital economy fosters transformations in production modes, lifestyle, and governance, thereby facilitating an improvement in the level of entrepreneurship (Audretsch, Heger, & Veith, 2015; Luo, Peng, & Zeng, 2021; Sun & You, 2023). On one hand, the pervasive influence of the digital economy across all aspects of production and daily life has led to the emergence of numerous new technologies and products, driving the transformation and upgrading of traditional industries and consequently fostering entrepreneurial activities (Zhao & Yi, 2022). On the other hand, credit constraints represent a significant barrier to entrepreneurship. The digital economy serves to alleviate these constraints and equalize entrepreneurial opportunities (Evans & Jovanovic, 1989; Karaivanov, 2012). The entrepreneurial opportunities emerging from the digital economy afford migrants greater room for development, enabling them to realize their potential and integrate into the local society — thus enhancing their settlement intentions.

In the context of the digital economy, there exists a second key factor contributing to the positive impact on migrants' settlement intentions. Specifically, the widespread adoption of the Internet and the advancements in digital technology have resulted in the creation of additional income sources and higher income levels for migrants (Jin, 2017; Zhang et al., 2019). On one hand, the digital economy facilitates convenient access to education, work, and social interactions for residents, leading to enhanced human capital among migrants and thereby increasing their labor productivity and job prospects (Krueger, 1993; Peter, Kuhn, & Mansour, 2014). On the other hand, the digital economy effectively reduces the information gap and mitigates issues related to information asymmetry by facilitating the dissemination of supply and demand information within the labor market (Stiger, 1962). With a comprehensive understanding of market dynamics, migrants can improve efficiency in matching labor supply and demand, ultimately resulting in increased income levels. Overall, the digital economy offers migrants amplified entrepreneurial opportunities and improved income

prospects, thereby bolstering their settlement intentions (Lu & Chen, 2022; Wang et al., 2022).

The impact of the digital economy on migrants in disadvantaged situations appears to be particularly pronounced. With its emphasis on technology and sharing, the digital economy not only drives economic growth but also fosters a mechanism for achieving balanced development. Over the past few decades, urbanization and industrialization have considerably elevated living standards for all individuals, including those from low-income backgrounds. However, this progress has also been accompanied by increasing inequality, characterized by widening gaps across regions, urban-rural divides, households, and industries (Afridi, Li, & Ren, 2015; Greaney & Li, 2017; Mendoza, 2018; Wan, 2013). Thanks to rapid advancements in information and communication technologies such as cloud computing, artificial intelligence, and the Internet, geographical and temporal constraints have been dismantled. The digital economy presents cost-effective convenience to society as a whole, particularly benefiting disadvantaged groups (Xie, Shen, Zhang, & Guo, 2018; Yin, Peng, & Lyons, 2019). Existing research indicates that the digital economy promotes the sharing of opportunities arising from economic growth by facilitating entrepreneurial endeavors among residents (Audretsch et al., 2015; Luo et al., 2021; Sun & You, 2023), increasing income levels for agricultural hukou holders (Ma & Hu, 2022), and alleviating relative poverty (Liu, Zhang, & Wang, 2021). By enabling fair and equitable sharing of the fruits of economic growth, the digital economy strives for inclusive growth that benefits all members of society.

3. Data, variables, and methods

This study primarily utilizes data from the CMDS, a comprehensive household survey conducted by the Migrant Population Service Center under the National Health Commission of China. The CMDS aims to holistically collect detailed information on migrants' demographic and socioeconomic characteristics nationwide. By employing a hierarchical and multi-stage probability proportional to size (PPS) sampling method, the survey encompasses a substantial sample size of approximately 200,000 households per year. This survey has been conducted annually since 2010 and incorporates extensive data on migrants and their respective family members. For this analysis, the latest available dataset from the CMDS is the 2018 wave. Our focus is on the period between 2014 and 2018 due to missing information regarding settlement intentions in other waves. Given that the CMDS also captures the geographic location of each respondent, it enables us to match city-level information on the digital economy with specific household characteristics. Information concerning the digital economy is sourced from various reputable databases, namely the Institute of Digital Finance at Peking University, the Macro Economy and Real Estate database at the State Information Center, and the Statistical Yearbook of Chinese Cities. After eliminating observations with missing values and restricting our sample to adults aged 18 years or above, we selected a final sample of 621,687 migrants from a total population of 799,157 migrants residing in 276 cities.

The dependent variable in this study is migrants' settlement intention, which is measured by asking each respondent in the CMDS whether they plan to live in their current location for more than five years. To operationalize this, we create an indicator variable for settlement intention, denoted as "1″ if the respondent plans long-term residence and "0″ otherwise. The main explanatory variable of interest is the development level of the digital economy. Drawing on the work of Zhao et al. (2020), we employ five key indicators to gauge the digital economy's development: Internet penetration rate (number of broadband access users per 100 people), employment situation (proportion of computer service and software workers), output situation (total number of telecom services per capita), mobile phone penetration rate (number of mobile phone users per 100 people), and a digital financial inclusion index. [2] The digital financial inclusion index, compiled by the Digital Finance Research Center of Peking University's Institute of Digital Finance using extensive micro-level customer data from Ant Group, encompasses three primary indicators (digital financial coverage, depth of digital financial use, and digitization degree of inclusive finance) and 33 secondary indicators. Calculating the digital economy index involves employing principal component analysis. There are two mediating variables considered in our analysis: entrepreneurship and income, following the approach outlined by Ma and Hu (2022). Entrepreneurship is represented by an indicator variable, distinguished as "1″ for respondents categorized as "employer" or "self-employed" and "0″ for those classified as "employee." Income is captured by the logarithm of average monthly household income. Controlling for various factors, both at the individual and city levels, we include several control variables. Individual-level characteristics consist of gender (male = 1, female = 0), age, marital status (married = 1, unmarried = 0), household registration nature (agricultural = 0, non-agricultural = 1), family size, education level (represented by a set of dummy variables, including 1) junior high school and below, 2) senior high school, and 3) junior college, undergraduate, and postgraduate degrees), migration distance (measured by a set of dummy variables, including 1) intra-city/inter-county, 2) intra-provincial/inter-city, and 3) inter-provincial movements), and migration duration. These control variables are drawn from studies by Huang and Ren (2022), Liu et al. (2013, 2017), Lin and Zhu (2016, 2022), and Zhu et al. (2016). Additionally, city-level characteristics are taken into account, including GDP, total electricity consumption, housing price, wastewater displacement, and total population. These city-level variables are treated logarithmically in the econometric analysis, following the method established by Zhang and Liu (2022).

In Fig. 1, we observe the settlement preferences of migrants. Among the full sample, it is evident that 56.26% of migrants express a willingness to settle down, whereas 43.74% of migrants indicate an unwillingness to do so. This finding indicates that a substantial majority of migrants prefer to establish long-term residence in cities. Fig. 2 illustrates the relationship between migrants' settlement intentions and the level of digital economy development in their respective cities. The data reveals that migrants residing in cities with higher levels of digital economy development display a greater inclination to settle down. Conversely, migrants residing in cities

[2] Table A1 in the appendix shows the statistic description of these five indicators.

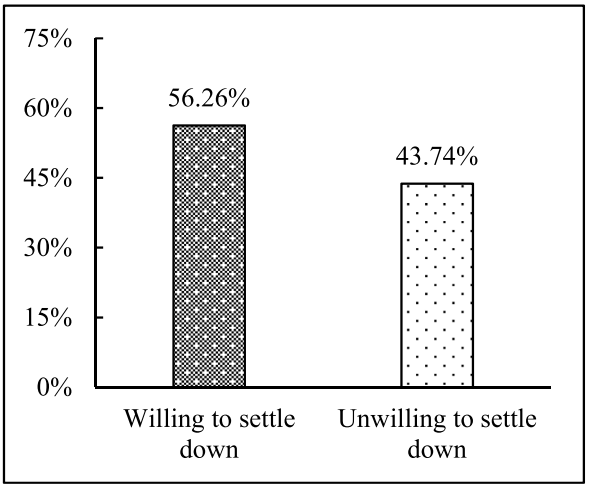


Fig. 1. Settlement intention.

characterized by lower levels of digital economy development exhibit a decreased willingness to settle down. These findings imply that the digital economy may exert a positive influence on migrants' settlement intentions.

Regarding individual characteristics, Table 2 presents key findings (see Table 1). The proportion of males among migrants is recorded at 58.55%, while the average age of migrants is approximately 35.18 years old. Additionally, a significant majority (79.68%) of migrants are married. Roughly 20.08% of migrants hold a non-agricultural hukou, highlighting their urban residence status. The average family size is 2.80. An analysis of educational attainment reveals that the largest proportion of migrants (60.55%) have achieved junior high school education or below, whereas those with junior college, undergraduate, or higher degrees account for the smallest portion (16.98%). On average, migrants have been living in their current location for approximately 5.28 years, and inter-provincial migration represents the largest proportion (50.23%), indicating long-distance migration as the predominant trend. Turning to entrepreneurial endeavors, Table 2 displays that 38.60% of migrants have chosen to start their own businesses, demonstrating a considerable entrepreneurial spirit within this population. Furthermore, the average monthly household income is estimated at around 6859 yuan.

We use a panel data regression model to analyze the relationship between the digital economy and the settlement intention of migrants. The regression model is set as follows:

$$Settle_{i,j,t} = \alpha_0 + \alpha_1 DE_{j,t} + \alpha_2 X_{i,j,t} + year_t + region_j + \varepsilon_{i,j,t} \quad (1)$$

Where the explained variable $Settle_{i,j,t}$ represents the settlement intention of the migrant i in the city j of year t. $DE_{j,t}$ represents the digital economy of the city j of year t. $X_{i,j,t}$ is a vector of control variables. $year_t$ represents the year fixed effect, $region_j$ represents the region fixed effect, and $\varepsilon_{i,j,t}$ represents the random disturbance term. We expect that α_1 is positive and statistically significant, indicating that the digital economy promotes the settlement intention of migrants.

4. Baseline analysis

We employ the linear probability model (LPM) to estimate Equation (1) due to its ease of interpretation and the qualitative similarity of results to non-linear models in large sample analyses. Table 3 provides the findings from two separate regressions that gradually expand the number of control variables, allowing for an assessment of the sensitivity of treatment effects (Oster, 2019). Column (1) of Table 3 controls for household characteristics, city-fixed effects, and year-fixed effects. In addition, column (2) of Table 3 adds control variables for city characteristics. The results reveal a significant positive association between the digital economy and migrants' settlement intentions, with statistical significance at the 1% level. Specifically, for every unit increase in the digital economy, there is a corresponding increase of 0.0073 percentage points in the probability of settling in cities. Considering that the average likelihood of settlement intention is 0.5626, the observed increase amounts to a significant 1.30 percentage-point rise in the probability of settlement intentions.

Female migrants express stronger settlement intentions, potentially attributable to enhanced employment opportunities arising from the development of the service industry in their current city. Age demonstrates a significant positive impact on settlement intentions, while the squared term of age presents a significant negative impact. This implies an inverse U-shaped relationship between age and settlement intentions, indicating that as age increases, settlement intentions initially rise and subsequently decline. Marital status and family size exert a significant positive influence on settlement intentions. Migration with a focus on marriage and family promotes increased family stability and settlement intentions among migrants. Non-agricultural hukou status holds a significantly positive effect on settlement intentions. Regarding education level, migrants with senior high school or higher education exhibit a stronger intention to reside compared to those with junior high school education or below. This discrepancy may stem from higher

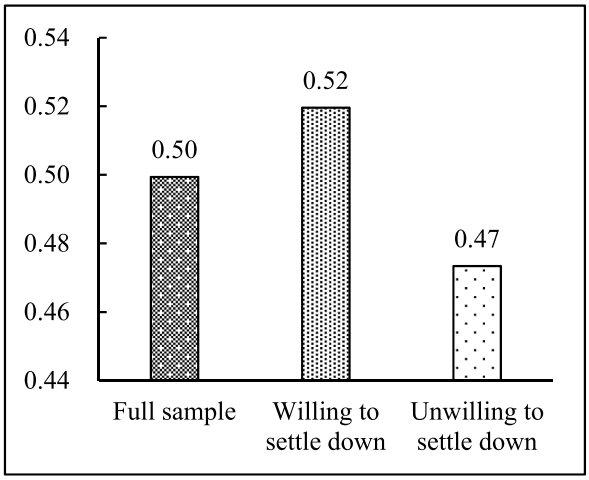


Fig. 2. Digital economy.

Table 1
Definitions of variables.

Variables	Definitions of variables	Data sources
Settlement intention	Plan to live in the place for the long term = 1, otherwise = 0	CMDS
Digital economy	The digital economy index is calculated based on the principal component analysis	Institute of Digital Finance of Peking University; Statistical Yearbook of Chinese Cities
Gender	Male = 1, Female = 0	CMDS
Age	Age of respondents	CMDS
Marital status	Married = 1, Unmarried = 0	CMDS
Hukou	Agricultural = 0, otherwise = 1	CMDS
Family size	Number of family members	CMDS
Education	Junior high school and below = 1, otherwise = 0; Senior high school = 1, otherwise = 0; Junior college, undergraduate or above = 1, otherwise = 0	CMDS
Migration distance	Intra-city/inter-county = 1, otherwise = 0; Intra-provincial/inter-city = 1, otherwise = 0; Inter-provincial = 1, otherwise = 0	CMDS
Migration duration	Years	CMDS
GDP	Billion yuan	Statistical Yearbook of Chinese Cities
Electricity consumption	Twh	Statistical Yearbook of Chinese Cities
Housing price	Yuan per square meter	Macro Economy and Real Estate Database of the State Information Center
Wastewater displacement	Ten thousand tons	Statistical Yearbook of Chinese Cities
Population	Ten thousand people	Statistical Yearbook of Chinese Cities
Entrepreneurship	Employer = 1, otherwise = 0	CMDS
Income	Average monthly household income	CMDS

education leading to better job prospects and higher income, thereby fostering a greater willingness to remain in the destination to fulfill personal aspirations. Migration distance also plays a role, as intra-provincial and inter-provincial migrants demonstrate a lower intention to settle compared to intra-city and inter-county migrants. This discrepancy may be attributed to factors such as nostalgia, cultural differences, and customs influencing the stronger pull towards returning to one's hometown as mobility range and distance from the destination increases. Migration duration positively influences settlement intentions, indicating that longer periods of residence contribute to better integration into the local community and increased settlement intentions. The level of urban economic development, captured by GDP, exhibits a significantly positive impact on settlement intentions. Likewise, the total amount of electricity usage, reflective of industrial development and quality of life, yields a similar result. These findings indicate that higher levels of urban development enhance the attraction for migrants and strengthen their settlement intentions. However, housing prices negatively affect settlement intentions among the floating population, as high housing costs intensify living pressures for migrants. Moreover, the discharge of wastewater and population size both exert a significant negative impact on migrants' settlement intentions. These implications suggest that deteriorating living environments, traffic congestion, and employment difficulties arising from population growth diminish migrants' settlement intentions.

Table 2
Summary statistics.

Variables	Full sample	Willing to settle down	Unwilling to settle down
Settlement intention	0.5626		
Digital economy	0.4994	0.5196	0.4734
Gender	0.5855	0.5874	0.5831
Age	35.1774	35.8681	34.2892
Marital status	0.7968	0.8563	0.7203
Hukou	0.2008	0.2337	0.1585
Family size	2.8040	2.9971	2.5556
Education			
Junior high school and below	0.6055	0.5645	0.6581
Senior high school	0.2247	0.2278	0.2207
Junior college, undergraduate or above	0.1698	0.2077	0.1212
Migration distance			
Intra-city/inter-county	0.1808	0.1996	0.1567
Intra-provincial/inter-city	0.3169	0.3435	0.2827
Inter-provincial	0.5023	0.4569	0.5606
Migration duration	5.2788	6.2858	3.9838
Employment status	0.3860	0.4255	0.3351
Income	6859	7576	5935
Observations	621687	349735	271952

Data source: CMDS 2014, 2015, 2016, 2017, and 2018, the Institute of Digital Finance of Peking University, and the Statistical Yearbook of Chinese Cities.

Table 3
Digital economy and settlement intention of migrants: Linear models.

	(1)	(2)
Digital economy	0.0193***	0.0073***
	(0.0007)	(0.0013)
Gender (ref = Female)	−0.0027**	−0.0027**
	(0.0012)	(0.0012)
Age	0.0137***	0.0139***
	(0.0005)	(0.0005)
Age squared	−0.0002***	−0.0002***
	(0.0000)	(0.0000)
Marital status (ref = Unmarried)	0.0990***	0.0990***
	(0.0020)	(0.0020)
Hukou (ref = Agricultural hukou)	0.0563***	0.0579***
	(0.0016)	(0.0016)
Family size	0.0537***	0.0531***
	(0.0006)	(0.0006)
Education (ref = Junior high school and below)		
Senior high school	0.0736***	0.0732***
	(0.0015)	(0.0015)
Junior college, undergraduate or above	0.2001***	0.2001***
	(0.0018)	(0.0018)
Migration distance (ref = Intra-city/inter-county)		
Intra-provincial/inter-city	−0.0195***	−0.0363***
	(0.0017)	(0.0018)
Inter-provincial	−0.1221***	−0.1351***
	(0.0018)	(0.0019)
Migration duration	0.0184***	0.0183***
	(0.0001)	(0.0001)
GDP		0.0255***
		(0.0019)
Electricity consumption		0.0219***
		(0.0012)
Housing price		−0.0120***
		(0.0024)
Wastewater discharge		−0.0081***
		(0.0009)
Population		−0.0334***
		(0.0016)
Year fixed effect	Yes	Yes
Rgion fixed effect	Yes	Yes
R-squared	0.1248	0.1268
Observations	621687	621687

Note: Standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1.

5. Robustness checks

The main empirical results presented in this study should be interpreted with caution due to potential sources of bias. Three key factors that could introduce bias include: (1) model misspecification, (2) measurement error, and (3) endogeneity of the digital economy variable. Through rigorous analyses, we find that the main empirical results withstand these challenges.

5.1. Model misspecification

To address concerns regarding model misspecification, we employ the probit model to estimate Equation (1) as an alternative analysis. The estimated results from the probit models are presented in Table 4. In line with the baseline regression findings reported in Table 3, our results from the probit models demonstrate that the coefficient of the digital economy variable remains positive and statistically significant at the 1% level. These consistent findings across different model specifications suggest the robustness of our results and provide support for the association between the digital economy and migrants' settlement intentions.

5.2. Measurement error

In line with previous studies conducted by Xie et al. (2018) and Xu, Yang, Huang, and Failler (2022), we adopt three alternative proxy variables for the digital economy. The first one is the Internet penetration rate. The second one is the digital financial inclusion index. Finally, we use the entropy weight method instead of the previously used principal component analysis to construct the digital economy index. To assess the robustness of our findings, we present the results in Table 5, utilizing both the LPM and probit models based on these alternatively defined measures of the digital economy. Once again, we find a consistent and statistically significant positive correlation between the digital economy and migrants' settlement intentions.

Table 4
Robustness results: Non-linear models.

	(1)	(2)
Digital economy	0.0558***	0.0228***
	(0.0019)	(0.0039)
Gender (ref = Female)	−0.0066*	−0.0068**
	(0.0034)	(0.0034)
Age	0.0372***	0.0377***
	(0.0014)	(0.0014)
Age squared	−0.0005***	−0.0005***
	(0.0000)	(0.0000)
Marital status (ref = Unmarried)	0.2668***	0.2674***
	(0.0056)	(0.0057)
Hukou (ref = Agricultural hukou)	0.1633***	0.1682***
	(0.0046)	(0.0047)
Family size	0.1500***	0.1483***
	(0.0018)	(0.0018)
Education (ref = Junior high school and below)		
Senior high school	0.2064***	0.2056***
	(0.0043)	(0.0043)
Junior college, undergraduate or above	0.5731***	0.5742***
	(0.0054)	(0.0054)
Migration distance (ref = Intra-city/inter-county)		
Intra-provincial/inter-city	−0.0535***	−0.1004***
	(0.0050)	(0.0052)
Inter-provincial	−0.3378***	−0.3749***
	(0.0051)	(0.0053)
Migration duration	0.0538***	0.0536***
	(0.0004)	(0.0004)
GDP		0.0691***
		(0.0055)
Electricity consumption		0.0614***
		(0.0033)
Housing price		−0.0316***
		(0.0069)
Wastewater discharge		−0.0224***
		(0.0025)
Population		−0.0932***
		(0.0046)
Year fixed effect	Yes	Yes
Region fixed effect	Yes	Yes
R-squared	0.0975	0.0991
Observations	621687	621687

Note: Standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1.

Table 5
Robustness results: alternative measures of digital economy.

	(1)	(2)	(3)	(4)	(5)	(6)
	LPM	Probit	LPM	Probit	LPM	Probit
Internet penetration rate	0.0022***	0.0059***				
	(0.0004)	(0.0013)				
Digital financial inclusion			0.0654***	0.1822***		
			(0.0121)	(0.0343)		
Digital economy (Entropy weight)					0.0671***	0.2015***
					(0.0098)	(0.0281)
Individual characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Migration relative characteristics	Yes	Yes	Yes	Yes	Yes	Yes
City characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	621687	621687	621687	621687	621687	621687

Note: Standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1.

5.3. Endogeneity of digital economy

The endogeneity of the digital economy may arise for two primary reasons. First, previous estimations may have overlooked certain unobservable factors that influence both the digital economy and individuals' inclination to settle down, despite our inclusion of relevant observed household characteristics and unobserved city characteristics as controls. Second, the influx of migrants could stimulate the development of the digital economy through the agglomeration effect of human capital.

To address these concerns, we employ two commonly used econometric techniques: two-stage least squares (2SLS) and instrumental variable probit (IVP) analyses. Following the methodology outlined in Nunn and Qian (2014), we utilize an instrument variable (IV) to tackle the issue of endogeneity in the digital economy. Specifically, we construct the IV by using the interaction term between the number of Internet users in China and the number of telephones per 100 people in each city in 1984. In the first stage, the F-statistic exceeds 10 and is statistically significant, indicating a strong correlation between the IV and the digital economy. Turning to the results from the second-stage equation obtained through the 2SLS and IVP models, as presented in Table 6, we find that the coefficient of the digital economy remains positive and statistically significant. These findings reinforce the robustness of our results, suggesting that our earlier estimates are not compromised by the potential endogeneity of the digital economy.

6. Further analysis

To examine the potential mediation effect of entrepreneurial engagement and income on the relationship between the digital economy and migrants' settlement intentions, we employ a mediation analysis framework. This analysis consists of three sequential steps, each designed to explore different aspects of the mediation process. In the first step, we regress settlement intention on the digital economy variable alongside relevant covariates, as stated in Equation (1). Moving on to the second step, we regress the mediating variable (M) on the digital economy and the same set of covariates as before, as indicated in Equation (2). This step enables us to evaluate whether the digital economy influences the mediating variable. Finally, in the third step, we perform a regression where settlement intentions are regressed on both the digital economy, the mediating variable, and again, the covariates included in previous equations. This analysis, expressed in Equation (3), allows us to explore how much of the relationship between the digital economy and

Table 6
Robustness results: 2SLS and IVP approaches.

	2SLS	IVP
	(1)	(2)
Second stage		
Digital economy	0.0074***	0.0221***
	(0.0008)	(0.0024)
First stage		
IV	0.0024***	0.0024***
	(0.0000)	(0.0000)
Individual characteristics	Yes	Yes
Migration relative characteristics	Yes	Yes
City characteristics	Yes	Yes
Year fixed effect	Yes	Yes
Region fixed effect	Yes	Yes
R-squared	0.1246	–
Observations	481865	481865

Note: Standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1.

settlement intentions can be explained by the role of entrepreneurial engagement and income as mediators.

$$M_{i,j,t} = \gamma_0 + \gamma_1 DE_{j,t} + \gamma_2 X_{i,j,t} + year_t + region_j + \varepsilon_{i,j,t} \quad (2)$$

$$Settle_{i,j,t} = \eta_0 + \eta_1 DE_{j,t} + \eta_2 M_{i,j,t} + \eta_3 X_{i,j,t} + year_t + region_j + \varepsilon_{i,j,t} \quad (3)$$

Columns (1) and (2) in Table 7 present the results obtained from Equations (2) and (3), respectively, using an indicator variable for entrepreneurship as the mediating variable. The findings reveal a positive and significant impact of the digital economy on entrepreneurship, indicating that it fosters entrepreneurial engagement among migrants. Additionally, the coefficient of the digital economy remains positive but slightly smaller compared to the baseline results reported in column (2) of Table 3 (0.0072 in column (2) of Table 7 vs. 0.0073 in column (2) of Table 3). This finding suggests that entrepreneurship partially explains the relationship between the digital economy and migrants' settlement intentions. Moving on to columns (3) and (4) of Table 7, we explore the mediating effect of household income. In Equation (2), the results demonstrate a significant and positive impact of the digital economy on the household income of migrants. Furthermore, increased household income is positively associated with higher settlement intentions. Notably, even after controlling for household income, the digital economy maintains a significant and positive impact on migrants' settlement intentions in Equation (3). However, the magnitude of the coefficient decreases (0.0062 in column (4) of Table 7 vs. 0.0073 in column (2) of Table 3). These findings suggest that increased household income also plays a partial role in explaining why the digital economy promotes the settlement intentions of migrants. By investigating the mediating effects of entrepreneurship and household income, our analysis provides valuable insights into the underlying mechanisms through which the digital economy influences migrants' settlement intentions. However, further analyses and robustness checks are necessary to confirm these findings and explore

Table 7
Possible explanations: Entrepreneurship and income.

	(1)	(2)	(3)	(4)
	Entrepreneurship	Settlement intention	Household income	Settlement intention
Digital economy	0.0030**	0.0072***	0.0106***	0.0062***
	(0.0013)	(0.0013)	(0.0015)	(0.0013)
Entrepreneurship		0.0502***		
		(0.0013)		
Income				0.0958***
				(0.0013)
Gender (ref = Female)	0.0116***	−0.0033***	0.0177***	−0.0044***
	(0.0012)	(0.0012)	(0.0013)	(0.0012)
Age	0.0204***	0.0129***	0.0233***	0.0117***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Age^2	−0.0002***	−0.0002***	−0.0004***	−0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Marital status (ref = Unmarried)	0.0995***	0.0940***	0.2992***	0.0703***
	(0.0018)	(0.0020)	(0.0022)	(0.0021)
Hukou (ref = Agricultural hukou)	−0.0282***	0.0594***	0.0958***	0.0488***
	(0.0015)	(0.0016)	(0.0017)	(0.0016)
Family size	0.0548***	0.0504***	0.1209***	0.0415***
	(0.0006)	(0.0006)	(0.0007)	(0.0006)
Senior high school	−0.0270***	0.0746***	0.0215***	0.0629***
	(0.0015)	(0.0015)	(0.0018)	(0.0015)
Junior college, undergraduate or above	−0.1724***	0.2088***	0.0995***	0.1735***
	(0.0017)	(0.0018)	(0.0019)	(0.0018)
Intra-provincial/inter-city	0.0425***	−0.0384***	0.0211***	−0.0383***
	(0.0018)	(0.0019)	(0.0019)	(0.0018)
Inter-provincial	0.0627***	−0.1383***	0.0995***	−0.1447***
	(0.0018)	(0.0019)	(0.0020)	(0.0019)
Migration duration	0.0068***	0.0179***	0.0015***	0.0181***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GDP	−0.0281***	0.0269***	0.0487***	0.0209***
	(0.0019)	(0.0019)	(0.0021)	(0.0019)
Electricity consumption	−0.0027**	0.0221***	−0.0467***	0.0264***
	(0.0011)	(0.0012)	(0.0013)	(0.0012)
Housing price	−0.0225***	−0.0109***	0.1688***	−0.0282***
	(0.0024)	(0.0024)	(0.0025)	(0.0024)
Wastewater discharge	−0.0178***	−0.0072***	0.0257***	−0.0106***
	(0.0009)	(0.0009)	(0.0010)	(0.0009)
Population	0.0337***	−0.0351***	−0.0050**	−0.0329***
	(0.0016)	(0.0016)	(0.0017)	(0.0016)
Year fixed effect	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes
R-squared	0.1454	0.1289	0.3026	0.1355
Observations	621687	621687	621687	621687

Note: Standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1.

additional channels linking the digital economy to settlement intentions.

In our prior analyses, we operated under the assumption of a uniform effect of the digital economy on migrants' settlement intentions. To delve deeper into this relationship, we extend our investigation to test whether the impact of the digital economy varies across different groups, particularly focusing on disadvantaged migrants. Previous research, as highlighted by Xie et al. (2018), indicates that the digital economy offers enhanced employment opportunities for disadvantaged migrants at a lower cost and with greater convenience. Migrants who possess agricultural hukou typically represent disadvantaged groups, frequently marginalized from local public services and social benefits (Chen & Hu, 2021). To test the differential effects of the digital economy on settlement intentions among distinct migrant subgroups, we estimate Equation (1) separately for two subsamples: migrants with agricultural hukou and migrants with non-agricultural hukou. The results, presented in columns (1) and (2) of Table 8, highlight interesting findings. Specifically, we observe that the digital economy significantly and positively influences the settlement intentions of migrants with agricultural hukou. However, the impact of the digital economy on settlement intentions among migrants with non-agricultural hukou is not statistically significant.

7. Conclusion

This study utilizes CMDS data from 2014 to 2018 and city-level digital economy indicators to investigate the impact of the digital economy on migrants' settlement intentions. Our findings robustly demonstrate that the digital economy positively influences migrants' settlement intentions, even after considering model misspecification, measurement error, and endogeneity issues associated with the digital economy. During China's ongoing urbanization process, a substantial number of rural residents have migrated to cities and towns (Huang & Ren, 2022; Hui, Wang, & Chen, 2015). The development of the digital economy not only provides improved development opportunities for these migrants but also injects fresh impetus into new urbanization endeavors (Chen & Liu, 2016; Liu et al., 2015). Furthermore, this paper presents two explanations for the positive association between the digital economy and migrants' settlement intentions. First, the digital economy facilitates entrepreneurial advancement. The higher level of urban digital economy development promotes entrepreneurial behavior among migrants (Luo et al., 2021; Sun & You, 2023). The resulting entrepreneurial opportunities offer migrants greater room for development, enabling them to realize their potential and effectively integrate into local society, thereby enhancing their long-term settlement intentions. Second, the digital economy generates additional income sources and higher income levels for migrants. With the proliferation of the Internet and advancements in digital technologies, the digital economy has created more revenue streams and increased wage yields for migrants (He et al., 2022; Lu et al., 2023; Xue et al., 2022). This improves their standard of living and quality of life, consequently strengthening their willingness to settle down. Moreover, our analysis reveals that the effect of the digital economy on migrants' settlement intentions is more pronounced for those with agricultural hukou compared to non-agricultural hukou holders. Agricultural hukou residents face disadvantages within the traditional economic development process and encounter socioeconomic challenges (Chen & Liu, 2016). However, the development of the digital economy offers them an avenue for more affordable and convenient advancement.

Our research findings shed light on the crucial social issue of migrants' settlement intentions and offer valuable policy implications. Urbanization plays a significant role in enhancing the efficiency of human resource allocation, stimulating domestic demand, and promoting high-quality economic development. Our results clearly demonstrate that the digital economy has a positive and influential role in encouraging migrants to settle down, providing compelling justification for government support and subsidies in this area. To facilitate the smooth and orderly flow of labor and attract labor inflow, it is imperative to continually advance the development of the digital economy and strengthen its impact on entrepreneurship and income generation. This entails considering entrepreneurial opportunities and economic returns when formulating policies and programs aimed at attracting migrants to urban areas. Furthermore, policymakers should pay special attention to migrants with agricultural hukou, who often experience limited access to public services in cities. Efforts should be intensified to assist these disadvantaged migrants, emphasizing inclusivity in the process of promoting digital economy development. Emphasizing people-centered approaches and continuously enhancing flexible governance and refined services will contribute to creating livable, inclusive, and humane cities. This approach aligns with the goals of constructing a new type of urbanization. Additionally, it is crucial to strengthen risk management during the developmental journey of the digital economy. Achieving a balance between data utilization and information security becomes increasingly pressing. On one hand, as data grows exponentially, harnessing digitalization's potential to empower industries is paramount. Concurrently, we must fortify measures to protect data from theft and misuse. On the other hand, while safeguarding information security, maximizing the extraction and utilization of data value and promoting open data sharing become essential factors in driving the prosperity and development of the digital economy. In summary, our research calls for government support for the digital economy to foster migrants' settlement intentions. Policymakers should prioritize the needs of disadvantaged migrants, strive for inclusivity, and enhance data management practices. These endeavors collectively contribute to the realization of a new type of urbanization and ensure sustainable and equitable development in urban areas.

Our study acknowledges several limitations that offer valuable avenues for future research. First, we have defined settlement intention as a binary indicator representing migrants' willingness to stay in cities for five years or more. To deepen our understanding of this phenomenon, it is advisable to explore additional types of settlement intentions, such as temporary and permanent settlement intentions, which can provide a more nuanced perspective on migrants' aspirations. Second, with the continuous expansion of digital infrastructure and technological advancements, there is a need for exploration and development of new measures to capture the multifaceted nature of the digital economy. Constantly evolving indicators related to the digital economy should be considered to better comprehend its impact on migrants' settlement intentions. Third, our research focuses on two mechanisms—the promotion of entrepreneurship and the enhancement of migrants' income—to explain the influence of the digital economy on settlement intentions.

Table 8
Heterogeneous results: non-agricultural hukou vs. agricultural hukou.

	(1)	(2)
	Migrants with non-agricultural hukou	Migrants with agricultural hukou
Digital economy	−0.0006	0.0056***
	(0.0027)	(0.0016)
Individual characteristics	Yes	Yes
Migration relative characteristics	Yes	Yes
City characteristics	Yes	Yes
Year fixed effect	Yes	Yes
Region fixed effect	Yes	Yes
R-squared	0.1212	0.1209
Observations	124820	496867

Note: Standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1.

However, there may be other underlying mechanisms worth investigating. Future studies could delve into additional explanations to further uncover the complex dynamics at play. Addressing these limitations through future investigations will contribute to a more comprehensive understanding of migrants' settlement intentions within the context of the digital economy. This knowledge will shed light on how policies and strategies can be structured to effectively support and accommodate the diverse needs and aspirations of migrant populations.

Appendix

Table A1
Summary statistics: Digital economy indicators

Variables	Obs	Mean	Std. dev.	Min	Max
Internet penetration rate	1399	24.627	18.706	0.3472	189.01
Employment situation	1399	0.0024	0.0052	0.0001	0.0611
Output situation	1399	1040.1	1238.3	48.611	13977
Mobile phone penetration rate	1399	109.58	79.172	11.111	1016.6
Digital financial inclusion index	1399	194.50	37.290	105.61	302.98

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