

**ROLE OF DIGITALIZATION,  
ENTREPRENEURSHIP AND  
FOREIGN DIRECT INVESTMENT  
ON URBAN-RURAL INCOME  
INEQUALITY IN CHINA**

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FOREIGN DIRECT INVESTMENT  
ON URBAN-RURAL INCOME  
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by

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## LIST OF ABBREVIATIONS

IE	Urban-rural income inequality
DIG	Digitalization
NSE	Entrepreneurship
FDI	Foreign direct investment
TERP	Service sector development level represents industrial structure
URBP	Urbanization level
EDU	Education
FTP	Fiscal transparency
GMM	Generalized Method of Moments
SYS-GMM	System GMM
DIF-GMM	Difference GMM
DV	Dependent Variable
VIIRS	Visible Infrared Imaging Radiometer Suite

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Appendix A Tables of entrepreneurship

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**PERANAN DIGITALISASI, KEUSAHAWANAN, DAN PELABURAN  
LANGSUNG ASING TERHADAP KETIDAKSAMAAN PENDAPATAN  
BANDAR-LUAR BANDAR DI CHINA**

**ABSTRAK**

Perkembangan ekonomi yang membanggakan di China dicemari oleh ketidakseimbangan pendapatan antara bandar dan desa. Kajian ini mencadangkan bahawa pendigitalan, keusahawanan dan pelaburan langsung asing merupakan faktor utama dalam menangani ketidakseimbangan pendapatan bandar-desa. Menggunakan kaedah Momen Teritlak (GMM) dan data daripada 265 bandar di China bagi tempoh 2013 hingga 2022, kajian ini mendapati bahawa pendigitalan berpotensi menjadi penyelesaian dalam mengurangkan ketidakseimbangan pendapatan bandar-desa, sejajar dengan objektif pertama kajian. Namun begitu, di kawasan yang mempunyai tahap pendigitalan yang rendah, kesan digital didapati kurang memberangsangkan dan memerlukan sokongan tambahan seperti peningkatan dalam aktiviti keusahawanan. Bagi objektif kedua, iaitu untuk meneliti peranan keusahawanan terhadap ketidakseimbangan pendapatan bandar-desa, kajian ini menunjukkan bahawa keusahawanan memberi kesan yang berbeza mengikut tahap pendigitalan, tetapi secara keseluruhan ia membantu merapatkan jurang pendapatan. Sebagai tambahan, bagi menangani masalah ketidakcekapan pendigitalan dalam mengurangkan ketidakseimbangan, bukti terdahulu menunjukkan bahawa aktiviti ekonomi dapat dipertingkatkan melalui pembiayaan yang mencukupi dan akses kepada teknologi terkini. Jika dana dan teknologi tidak tersedia secara tempatan, ia boleh diperolehi melalui pelaburan asing. Maka, objektif ketiga kajian ini adalah untuk menguji peranan penengah aliran FDI dalam hubungan antara pendigitalan dan

jurang pendapatan bandar-desa di bandar-bandar China. Hasil kajian menunjukkan kesan yang lebih ketara di kawasan dengan jurang pendapatan yang lebih rendah. Sebagai cadangan dasar, pembangunan kemudahan internet yang menyeluruh termasuk perkhidmatan digital seperti sistem kiriman untuk menyokong perdagangan elektronik di kawasan desa adalah penting. Selain itu, pengembangan keusahawanan melalui kemudahan digital, insentif cukai, dan program latihan yang lebih baik juga sama penting dalam mengurangkan jurang pendapatan. Akhir sekali, selain menggalakkan aliran FDI khususnya ke kawasan berpendigitalan rendah, dasar di bandar-bandar berpendigitalan tinggi seharusnya menumpu kepada galakan kerjasama teknikal yang mengintegrasikan industri berteknologi tinggi dengan sektor tempatan, khususnya di kawasan desa..

**ROLE OF DIGITALIZATION, ENTREPRENEURSHIP AND FOREIGN  
DIRECT INVESTMENT ON URBAN-RURAL INCOME INEQUALITY IN  
CHINA**

**ABSTRACT**

The promising picture of China's booming economy is overshadowed by the issue of urban-rural income inequality. This study suggests that digitalization, entrepreneurship, and foreign direct investment (FDI) are key factors in addressing urban-rural income inequality. Using the Generalized Method of Moments (GMM) approach and covering 265 cities in China from 2013 to 2022, the study observes that digitalization is a potential solution for reducing urban-rural income inequality as the answer to the first objective. However, in low-digitalization areas, the digitalization level is too low to have the most significant impact, demanding more vitality for these cities, such as enhancing entrepreneurship. For the second objective, which is on the role of entrepreneurship on urban-rural income inequality, this study finds that entrepreneurship exhibits varying effects across different digitalization conditions. However, in most cases, it helps mitigate urban-rural income inequality. Furthermore, to address the potential ineffectiveness of digitalization in reducing inequality, which may be due to a lack of drivers to encourage active economic participation, historical evidence shows that economic activities can be stimulated by more funding and access to relatively up-to-date technology. If these technologies and funds are not available domestically, they can be obtained through inviting more foreign investment. Therefore, the third objective of this study is to examine the moderating role of FDI inflows in the relationship between digitalization and urban-rural income inequality in Chinese cities. The results show that this moderating effect is more

significant in low-income urban-rural areas. As part of the policy suggestions, developing internet infrastructure, including digital services, such as postal systems, to support rural e-commerce is also essential. Additionally, fostering entrepreneurship through better digital infrastructure, tax incentives, and training programs is equally critical for reducing the income gap. Finally, apart from promoting more FDI especially in low-digitalization areas, in high-digitalization cities, policies should encourage technical cooperation to integrate high-tech industries with local sectors, particularly those in rural areas.

# CHAPTER 1

## INTRODUCTION

### 1.1 Overview

After the reform and opening up in 1978, the economic progress in China has taken off with rapid industrialization and urbanization. According to the Chinese Bureau of Statistics, from 2013 to 2022, China has achieved an average annual GDP growth rate exceeding 6%, marking its economic expansion. China's remarkable economic expansion has propelled its GDP to reach 17.9 trillion US dollars in 2023, solidifying its status as the second-largest economy globally. According to the government announcement from the National Rural Revitalization Administration in China in 2021 that the problem of absolute poverty in China is resolved, the new goal of the country is shifted to focus on the problem of imbalance development, to achieve equity, which is also one of the Sustainable Development Goals of the United Nations. In 2017, China embarked on the rural revitalization strategy, aiming to expedite the modernization of agricultural development in rural areas, and improve the system, mechanism, and policy for balancing development. It shows that the government has begun to realize that the large urban-rural income gap is a problem.

The gap between the incomes of China's residents, however, has shown an increasing trend in fluctuations. According to data from the China National Bureau of Statistics, since 2000, China's overall Gini coefficient has crossed the warning line of 0.4 and has been rising year by year, the overall Gini coefficient in China was 0.317 in 1978 and rose to 0.496 in 2006, and remained above 0.45, which is wider than that in

developed countries, in other countries and regions of East Asia, and in the countries of the former Soviet Union and Eastern Europe (Norris et al., 2015). Past research has shown that reducing urban-rural income inequality within regions such as provinces, cities, can go a long way toward addressing overall national inequality (Góes & Karpowicz, 2017). There are more than 300 cities in China, and cities are the main carriers of economic development and resource concentration. The income gap within cities will affect the income distribution pattern of the whole country. If the urban-rural inequality in several cities in a province worsens, the urban-rural income inequality in the whole province will also worsen, thus affecting the overall income inequality of the country (Glaeser et al., 2009; Sicular et al., 2007; Peng & Dan, 2023). Thus, addressing urban-rural income inequality within cities has important implications for income equality at the provincial and national scales.

This study focuses on rural-urban income inequality within cities for three main reasons. Firstly, city-level data are more representative, capturing the pronounced disparities between urban and rural areas within cities. Using provincial data might mask inequalities within specific cities, leading to inaccurate assessments. Secondly, addressing rural-urban income inequality within cities holds significant practical importance. Cities serve as primary arenas for government policy implementation and reforms. Resolving such inequalities within cities is crucial for enhancing social equity and fostering economic development. Thirdly, city-level data facilitate easier policy intervention compared to provincial or national data. Government and decision-makers are more likely to focus on and engage with city-

level data, making policy intervention and improvement more accessible. Furthermore, grouping cities in the study allows policymakers to tailor policy guidance based on each city's unique characteristics, offering more targeted solutions.

In the backdrop of a widening income gap nationally, the focus of governments has shifted from efficiency in growth, as how to develop the economy rapidly and roughly, to fairness, how to develop the urban and rural economies equitably, according to the 2014 Government Work Report of the State Council of China. Therefore, solving the problem of urban-rural income inequality in cities is one of the ways to realize sustainable social development, and is regarded as a key pillar for the realization of the country's overall prosperity (Berdegué et al., 2015; Ma et al., 2020; Zhou et al., 2023). There are many benefits for both economic development and society if the problem of urban-rural income inequality in cities in China can be solved. Reducing urban-rural income inequality in cities can increase the income and consumption capacity of the rural population (Tang et al., 2022), stimulate domestic demand, and promote balanced economic growth (Hu, 2002), thus reducing the country's dependence on external markets (Zhu et al., 2020); in addition, economic equality in cities can provide rural residents with better access to education and welfare, such as better health care, to increase the retention rate and attractiveness of talent in rural areas (Ayoroa et al., 2010; Camarero & Oliva, 2019; Zhang et al., 2025), and avoid the brain drain, preventing the loss of talented individuals from rural areas, which is conducive to fully utilizing the human resource potential of rural areas (Bobkov et al., 2023; Eastwood & Lipton, 2000), building a quality human capital

reserve for sustained economic progress, and promoting the development of the rural economy, ultimately benefiting the overall economic prosperity.

## 1.2 Background of Study

### 1.2.1 Urban-rural Equality

Urban-rural equality has emerged as an important goal following years of rapid economic development in China. The national Gini coefficient for per capita disposable income, obtained from the National Bureau of Statistics (Figure 1.2.1) shows that the Gini coefficient increased from 0.479 in 2003 to a maximum of 0.491 in 2008, indicating a widening income disparity. Despite a little decrease to 0.462 in 2015, the coefficient consistently fluctuated between 0.465 and 0.468 from 2016 to 2021, suggesting ongoing inequality. According to the national Gini coefficient, although not optimistic, China's income inequality is floating lower.

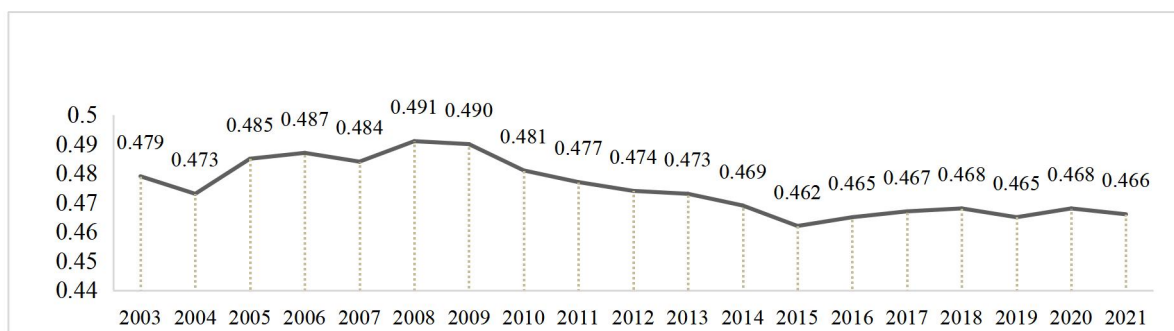


Figure 1.2.1 Gini coefficient of per capita disposable income of national residents from 2003 to 2021

Source: China National Statistical Yearbook (<https://www.stats.gov.cn>)

A variety of studies have illuminated the correlation between China's significant national income inequality and disparities among regions, as well as the growing income gap between urban and rural areas (Xue, 1997; Yao & Zhu, 1998; Khan & Riskin, 1998; Yang, 1999; Kanbur & Zhang, 1999; Li, 2003; Peng & Dan, 2023). Furthermore, the outcomes of income inequality decomposition in China have demonstrated a link between the overall national income inequality and the substantial urban-rural income inequality (Tsui, 1993; Hussain et al., 1994; Kanbur & Zhang, 1999; Jain Chandra et al., 2018). Li & Yue (2004) have calculated the shifts in the contribution rates of the three types of income inequalities to the national total inequality. Their findings reveal that, between 1995 and 2002, the contribution of the urban-rural income inequality to the overall national inequality increased markedly, from 36% to 43%. In addition, Sicular et al. (2008) have also indicated that in China, the differences in income between urban and rural areas significantly contribute to national inequality. Similarly, in Brazil, Góes & Karpowicz (2017) have found that the decline in overall inequality is partially driven by both the reduction in inequality within states and regions. Thus, it can be discerned that mitigating urban-rural inequality can lessen the total income inequality.

As China's economic expansion, the swift progress has significantly increased the financial status of the residents, as seen in Figure 1.2.2, the disposable income of urban and rural residents is both rising rapidly. The fact that the income gap has shown a declining trend, although at a very slow pace.

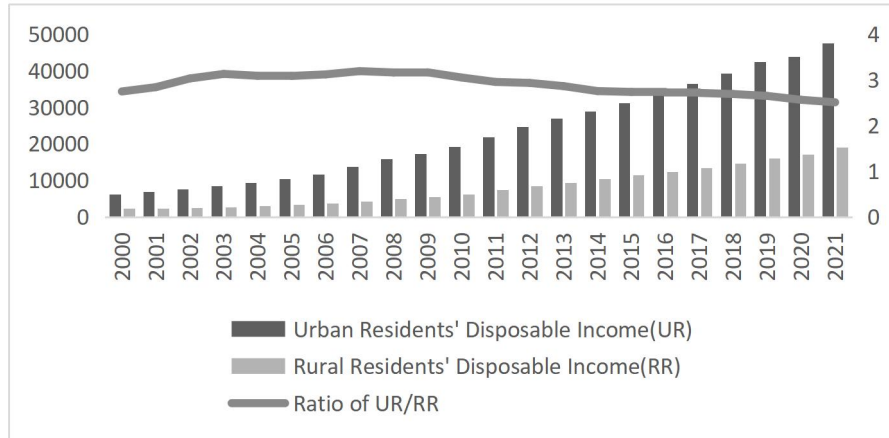


Figure 1.2.2 The ratio of the national disposable income of urban and rural residents (in Yuan)

Source: China National Statistical Yearbook (<https://www.stats.gov.cn>)

In earlier studies, scholars primarily define urban and rural areas based on traditional indicators such as population density and types of economic activities (Clark & Cushing, 2004; Zasada et al., 2013; Ögdül, 2010; Wineman et al., 2020; Zhang et al., 2025). As research progress, additional dimensions are considered, including infrastructure, public services, and sociocultural aspects (Hall et al., 2006; Short et al., 2016; Ortiz-Báez et al., 2021; Kaminski et al., 2021; Cattivelli, 2024). These studies have provided a wealth of perspectives and theoretical foundations for understanding urban-rural relationships. To go further into this topic, this research focuses on urban-rural income inequality (IE) and treats it as the core dependent variable.

In this study, the Gini coefficient is employed to quantify the urban-rural income gap, a method derived from the Lorenz curve and commonly used to measure the degree of income distribution disparity within a region (World Bank, 2017;

Elvidge et al., 2012). The Gini coefficient ranges from 0 to 1, with higher values indicating greater income inequality. Furthermore, due to the lack of data on per capita income at the township level, this study adopts an innovative approach in this study by using average nighttime light intensity as a proxy indicator. The validity of this method is supported by extensive literature (Chen & Nordhaus, 2011, 2019; Elvidge et al., 1997, 2012, 2013, 2014, 2017a, 2017b, 2021; etc.). These studies demonstrate that nighttime light data are closely correlated with economic indicators such as population, GDP, and energy consumption. Particularly, VIIRS nighttime light data have been proven to be an effective tool for estimating economic activities at small spatial scales (e.g., township-level GDP) (Chen & Nordhaus, 2019; Zhou et al., 2015; Yu et al., 2023).

Therefore, in this study, urban is understood as an area encompassing multiple developed townships, which typically have higher nighttime light intensities, representing a higher level of economic development, whereas rural refers to those townships with lower nighttime light intensities and relatively lagging economic development. By calculating the Gini coefficient of nighttime light intensity among townships within cities, the income gap between urban and rural areas can be calculated.

According to the urban-rural Gini coefficient at the city level calculated in this thesis, as shown in Figure 1.2.3, the five cities with the highest per capita income and the five cities with the lowest per capita income are selected by sorting the annual average of per capita income from 2013 to 2021, it can be observed that the urban-

rural income inequality level of high-income cities is obviously concentrated in the lower position, indicating that the urban-rural gap is comparatively smaller in high-income cities than that in lower-income cities.

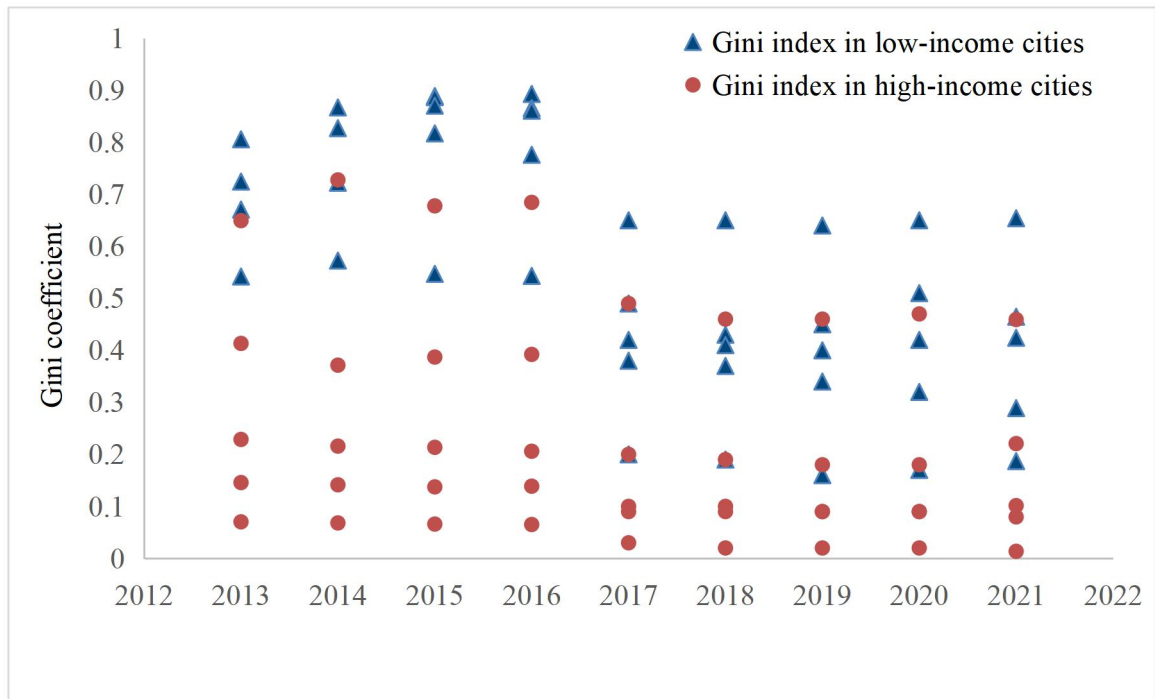


Figure 1.2.3 Gini index in selected 5 highest- and 5 lowest-income cities

Source: Gini index is calculated with nighttime light data from the Colorado School of Mines. <https://payneinstitute.mines.edu/eog-2/viirs/>

If urban-rural income inequality is effectively reduced, what benefits might arise? It could potentially enhance rural consumption capacity, diminish dependence on external markets, and establish a reserve of human capital for sustained economic progress, thereby fostering a more inclusive and prosperous society.

However, achieving urban-rural income equality in China requires diverse efforts and is affected by comprehensive social, economic, and policy factors. Some interesting developments in digitalization, entrepreneurship, and foreign direct investment could help shape the pattern of urban-rural equity development.

## 1.2.2 Digitalization

In recent decades, the impressive impact of digitalization has changed social dynamics and economic trends in many countries (Ono & Zavodny, 2007). China is a typical country of this digital revolution, as illustrated in Figure 1.2.4 by the rapid digitalization (DIG) development between 2013 and 2022 across China. The figure illustrates the rapid development of digitalization in China, spanning across nearly every region included in this study.

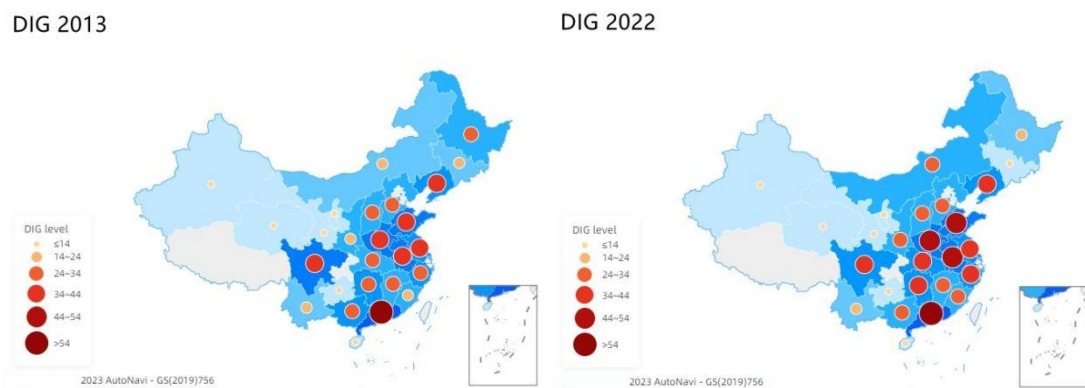


Figure 1.2.4 Spatial distribution of China's digitalization performance in 2013 and 2022.

Source: Author's calculation with data from China Urban Statistics Yearbook (<https://www.stats.gov.cn>)

According to the Report of China's Digital Economy Development (China Academy of Information and Communications Technology, 2024), in 2023, the size of China's digital economy is presented to hit 53.9 trillion yuan, constituting 42.8% of the nation's GDP for that year. In this digital era, it is difficult to avoid the impact of digital development when discussing the income gap between urban and rural residents in China. The adoption of digital technologies, such as the Internet, big data analytics, artificial intelligence, blockchain, and the Internet of Things, has been

shown to have a substantial impact on innovation and economic growth (Zhang et al., 2020; Dong et al., 2021; Luo et al., 2023). The use of these technologies in China has not only brought about significant changes in the country's business environment but has also had a great impact on the societal structure (Ren et al., 2021; Li et al., 2020).

From a city-level perspective, digitalization may facilitate people's lives, bring more possibilities to business, and make cities smart (Hatuka & Zur, 2020). However, the number of Chinese cities is so large that it is not appropriate to analyze the impact of digitalization on cities by putting all cities together. In this study, almost all cities are included and are divided into almost equal number of low, middle, and high-income groups according to per capita income levels, with more than 80 cities in each group. Figure 1.2.5 shows the relationship between digitalization level and urban-rural income gap with the Gini coefficient in high-income and low-income cities groups. In the case of low-income cities, the fitted value line is represented by a dashed line, the increasing digitalization does not seem to help reduce the urban-rural inequality represented by the Gini coefficient. But in the high-income cities group, when the digital level is generally higher than in another group, it shows a significant negative relationship with the Gini coefficient, that is, the higher the digital level, the smaller the Gini coefficient, which means that the urban and rural income tends to be equal. It can be observed as a reminder that digitalization might be a good solution to urban-rural income inequality under certain conditions.

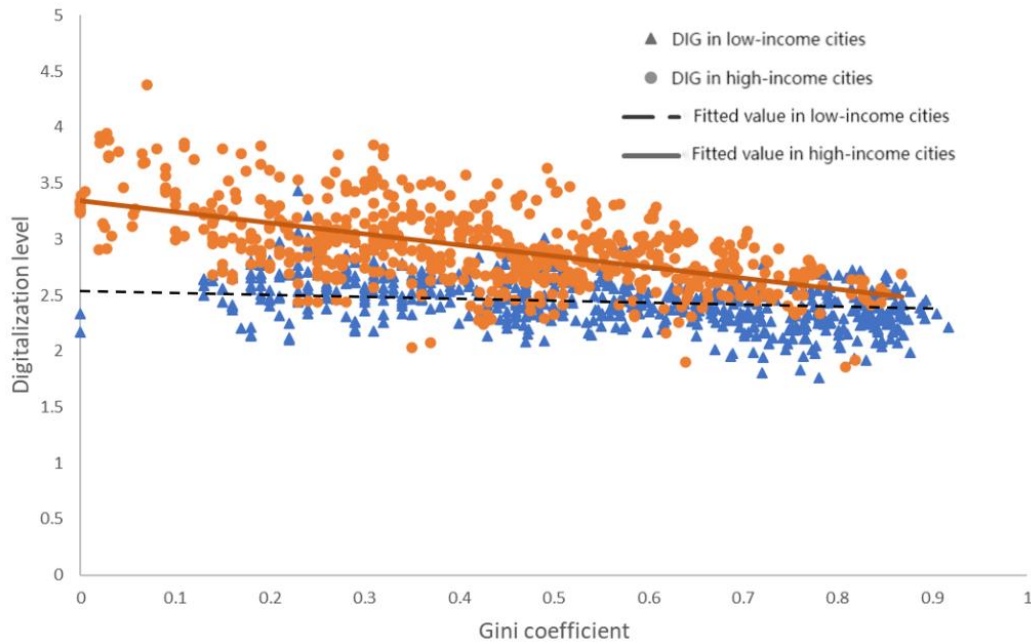


Figure 1.2.5 Digitalization level VS Gini coefficient

Source: Digitalization is calculated with data from China Urban Statistics Yearbook (<https://www.stats.gov.cn>)

It is widely acknowledged that digitalization holds the potential to promote economic development. However, although digitalization is present in all cities, many Chinese cities have not yet reached certain high levels of digitalization, which may limit its effectiveness in reducing urban-rural income disparities. This observation is supported by the analysis depicted in Figure 1.2.5, the relationship between digitalization and inequality in low-income cities is not apparent, with the fitted line for low-income cities running parallel to the X-axis. Conversely, high-income cities with higher levels of digitalization demonstrate a reduction in income inequality in Figure 1.2.5. As a result, digitalization levels in low-income cities are often much lower than those in high-income cities, and low digitalization levels may not be sufficient to reduce the rural-urban income gap, possibly because low-income cities often lack the resources and infrastructure needed to fully harness the potential

benefits of digitalization. For example, these cities' limited access to technology, inadequate skills training, and inadequate government support systems for entrepreneurship are likely to undermine digitalization's ability to reduce urban-rural inequality.

Given the digital inefficiencies in low-income cities, complementary measures to enhance the role of digitalization should be considered to help more cities achieve urban-rural equality. One possible approach is to promote entrepreneurship, as there is a significant disparity in entrepreneurship levels among cities, providing ample opportunity for government intervention to foster growth. Entrepreneurship might serve as a supplementary factor in helping reduce urban-rural inequality.

### **1.2.3 Entrepreneurship**

Entrepreneurship represents another potential factor that could impact urban and rural income inequality. In Chinese cities, where digitalization alone is hard to address the urban-rural income gap, promoting the enhancing role of entrepreneurship might offer a solution. As evident from Figure 1.2.6, the level of entrepreneurship varies significantly across cities, as evidenced by the count of new private startups per 100 individuals, reflecting each city's entrepreneurial activity. The upper round symbols represent cities with higher entrepreneurship values, in contrast to the triangle symbol area clustered at the bottom, where the level of entrepreneurship is significantly lower, between 0 and 2 only. This significant gap suggests that the government could have considerable opportunities to foster entrepreneurship in cities that with lower entrepreneurial activity levels.

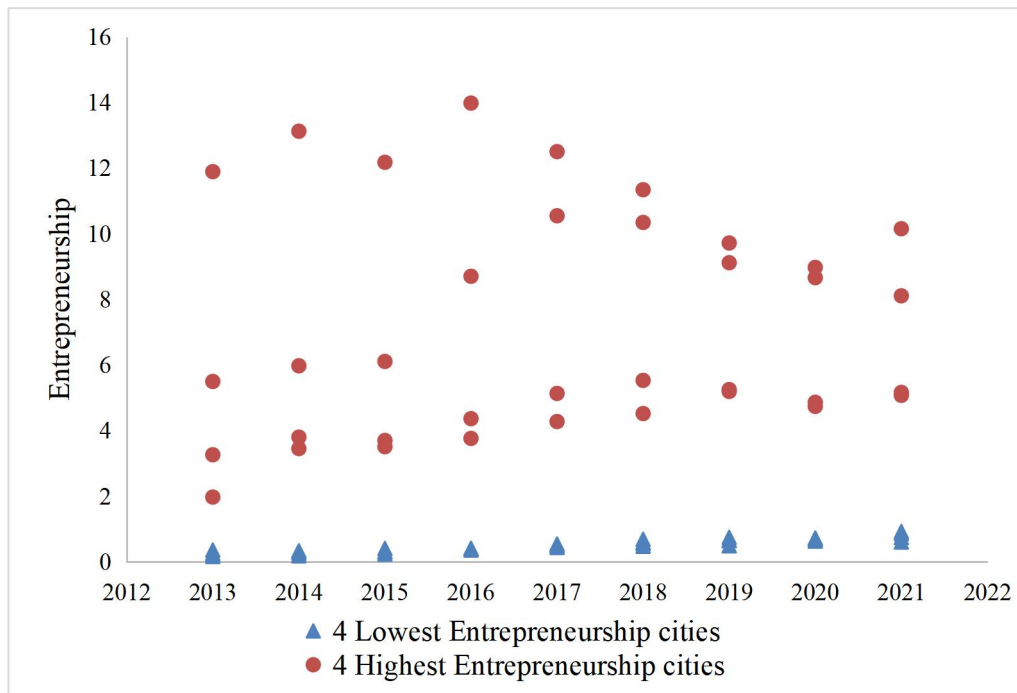


Figure 1.2.6 Comparison of entrepreneurship levels in cities with the highest and lowest entrepreneurship values

Source: Qixinbao database (<https://data.qixin.com>)

Entrepreneurship is often hailed as an engine for socio-economic transformation, some studies, such as those conducted by Naudé (2011) highlights the need for entrepreneurship studies to address income inequality. Also, Lippmann et al. (2005) propose that entrepreneurship increases individual income levels and improves social mobility, but the effects on income distribution have received less attention.

During the initial stage of China's reform and opening-up, Deng Xiaoping, then the Vice Premier of the State Council, introduced the policy of allowing certain individuals to become wealthy first. This policy aims to catalyze subsequent wealth creation and ultimately lead to widespread prosperity. This policy encourages the wealthy and entrepreneurs to prioritize investments and business activities, offering robust economic and institutional guarantees for innovation and entrepreneurship. Consequently, it has nurtured entrepreneurial-spirited individuals who through their

enterprises, have generated numerous employment opportunities and emerged as a force driving economic growth in both urban and rural markets. Furthermore, entrepreneurship, as a crucial factor stimulating innovation, development, and fostering new ventures, has provided strong support for advancing economic development. According to data released by the China Market Regulation Administration, by the end of 2012, the number of registered private enterprises has reached more than 10 million nationwide, accounting for 79.4% of the total number of enterprises. By the end of 2022, the number of private enterprises stood at 47 million, accounting for 93.3% of the total number of enterprises. It can be seen that the growth of entrepreneurship in China is considerable.

The Kuznets curve (Kuznets, 1955) illustrates the connection between income and income inequality, positing an inverted U-shaped relationship. As economic development progresses, income inequality initially rises with increasing income levels but eventually declines, forming the characteristic inverted U-shape (Alam & Paramati, 2016; Le et al., 2020). Specifically, inequality intensifies during early economic growth stages but diminishes as incomes reach higher thresholds (Nielsen & Alderson, 1997; Piketty & Saez, 2003; Wang et al., 2023a) Thus, according to Kuznets theory, income is the main determinant of income inequality. And entrepreneurship is an effective method to increase income (Halvarsson et al., 2018; Mohamad et al., 2021). Using the number of new private startups per 100 people (NSE) to represent the degree of entrepreneurship within the city, this study ranks almost all Chinese cities in terms of entrepreneurship from highest to lowest and

selected the five cities with the highest average entrepreneurship level in 2013 to 2022 to show in Figure 1.2.7. As illustrated in Figure 1.2.7, there is a significant negative correlation trend between the urban-rural Gini coefficient and the level of entrepreneurship in the most active entrepreneurship cities. This finding supports the opinion presented at the end of the previous sub-section (1.2.2 Digitalization), that high levels of entrepreneurship are conducive to reducing urban-rural income inequality.

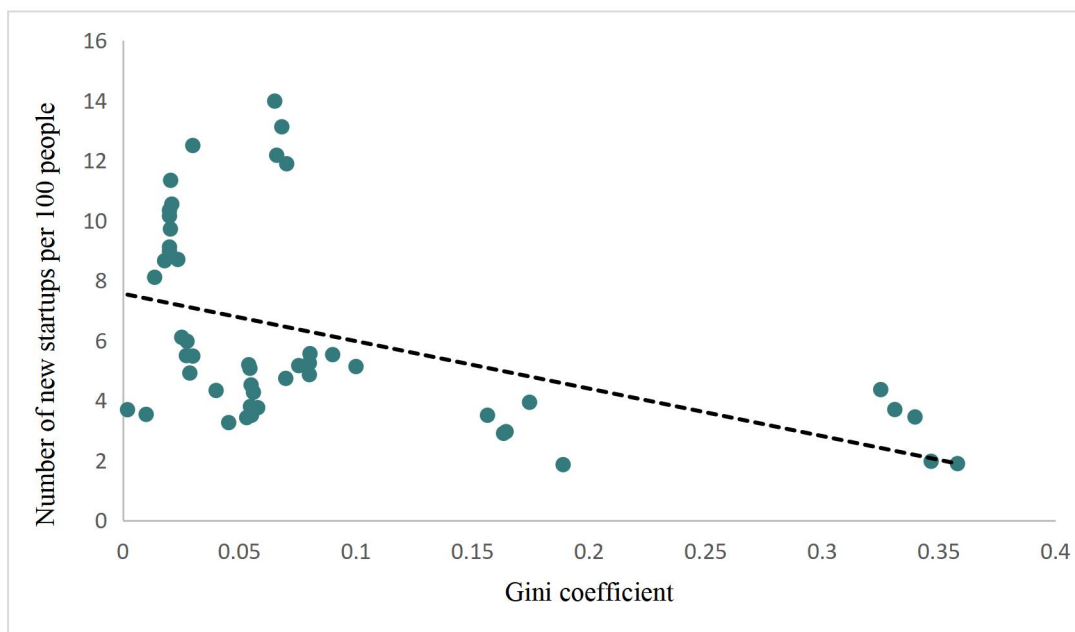


Figure 1.2.7 Number of new private startups per 100 people VS Gini coefficient in the highest five entrepreneurship cities (2013-2022)

Source: Qixinbao database (<https://data.qixin.com>)

Furthermore, this research not only divides the total sample cities into three groups based on their levels of digitalization (high, medium, and low) but also categorizes them based on per capita income levels. According to the ranking from low to high per capita income level, taking the lowest third, the middle third, and the highest third, cities are divided into low-, middle-, and high-income groups with an

almost equal number of cities in each group. The grouping by degree of digitalization follows a similar pattern. The dual classification approach used in this study helps to examine how digitalization affects urban-rural income inequality in groups with different income levels. In addition, this study will explore further on how entrepreneurship promotes or worsens this relationship.

#### **1.2.4 Foreign direct investment**

The likely ineffectiveness of digitalization in alleviating inequality issues could be due to a lack of push factors that can prompt people to actively engage in economic activities. As historically proven, economic activities can be activated with more funds and the availability of relatively up-to-date technology. If these cannot be made available domestically, they can be obtained by inviting more foreign companies to invest (Adams, 2009; Lall & Narula, 2004; Osano & Koine, 2016; Salim et al., 2017; Kemeny, 2010). It is inspired by The Heckscher-Ohlin model theoretically explains how FDI aligns with regional resources, often favoring capital and technology-intensive urban regions. China's FDI landscape has witnessed a significant transformation following the country's accession to the World Trade Organization (WTO) in 2001. Despite global economic uncertainties and the COVID-19 pandemic, China has seen resilient growth in FDI inflows, which increased annually by over 6% from 2020 to 2022 (Ministry of Commerce of China, 2023). The importance of FDI to host economies has been well documented in the literature (Borensztein, 1998; Iamsiraroj, 2016; Bermejo & Werner, 2018), including the case of China (Zhang, 2001; Tang et al., 2008; Su & Liu, 2016; Ding et al., 2024).

With the importance of FDI inflows as a source of capital, technology, and management skills to local industry for the development of the host economy or area, other potential benefits of FDI are creating a more competitive domestic market (Barrios et al., 2005; Ishikawa et al., 2010), bringing a greener technology (Song, et al. 2015; Amendolagine et al., 2021), spurring local innovation (Wang & Wu, 2016), improvement in host-country institutions (Kwok, & Tadesse, 2006). Empirical studies demonstrate the numerous benefits FDI brings to regional economic development. With China's expanding digitalization, the benefits of FDI and digitalization, such as through infrastructure investments, could have the chance to redistribute the benefits of FDI beyond urban centers to rural areas. FDI inflows have the potential to complement digitalization efforts, to boost the incomes of residents in remote areas in a city, thus narrowing income inequality between urban and rural areas. Referring to Figure 1.2.8 at the city level, it can be seen the correlation between FDI as a GDP proportion and urban-rural inequality (measured by the Gini coefficient) across selected four highest income cities and four lowest-income cities, in high-income cities the FDI ratio is generally higher compared to lower-income cities, and it can also be seen that high-FDI or high-income cities have lower urban-rural inequality level compared to lower-income or low-FDI cities. Therefore, FDI could probably help reduce urban-rural inequality, especially when rural areas receive a proportionately fair share of FDI inflows.

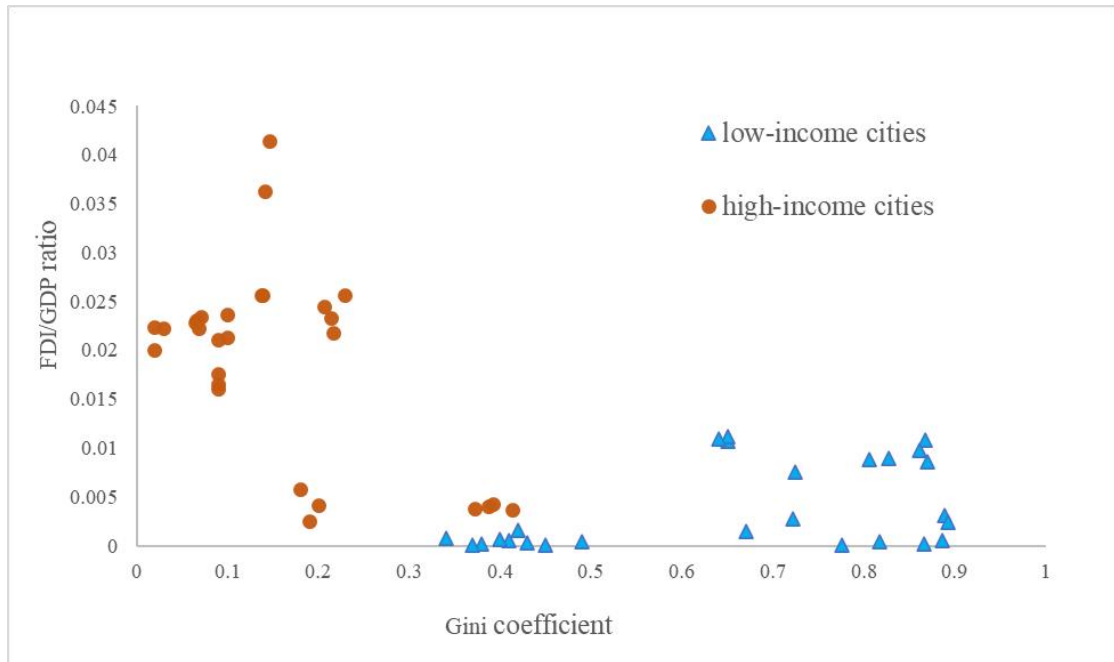


Figure 1.2.8 Gini VS FDI/GDP ratio in highest- and lowest-income cities  
 Source: China Urban Statistics Yearbook (<https://www.stats.gov.cn>)

Practically, as can be seen in Table 1.1, cities with the highest incomes at the right-hand part of table, generally have a higher FDI ratio, while cities representing the lowest income bracket on the left have very low FDI ratios. In other words, higher FDI may first offer huge industrialization opportunities in the urban areas, which later may spillover to the rural areas in those high-income cities so higher income cities get comparatively lower Gini coefficients. If we examine the experience of cities such as Shenzhen city in Guangdong province that initially relied heavily on FDI but now can stand alone and almost all areas, including rural become so developed. In this way, this study believes that the success in luring more FDI into low-income cities could possibly be helpful to solve the likely ineffectiveness of digitalization on urban-rural income inequality. It can be inferred that the higher FDI ratio in high-income cities has contributed to improving the digitalization and urban-rural income inequality

relationship, to get lower Gini coefficients. As demonstrated in Figure 1.2.8 in cities with lower incomes, which typically have a lower level of FDI and low level of digitalization, suggesting that low digitalization alone seemingly fails to narrow the urban-rural income gap.

Table 1.1 Comparison of Per Capita GDP in Cities in Highest VS Lowest FDI/GDP Values

3 lowest FDI/GDP cities	year	FDI/GDP(%)	Digitalization level	Per capita GDP (10,000 yuan)	3 highest FDI/GDP cities	year	FDI/GDP(%)	Digitalization level	Per capita GDP (10,000 yuan)
Zhaotong City	2020	0.0151	5.9708	2.5324	Maanshan City	2020	8.9342	12.2945	10.1218
Zhaotong City	2021	0.0282	5.6507	2.9158	Maanshan City	2021	7.9531	12.6575	11.3073
Weinan City	2020	0.0318	8.0832	3.9787	Zhuhai City	2020	4.8661	18.1669	11.2146
Weinan City	2021	0.0268	8.1473	4.5075	Zhuhai City	2021	4.134	19.0802	15.7377
Baise City	2020	0.0526	7.7137	3.7262	Dalian City	2020	1.36	23.4435	11.6856
Baise City	2021	0.0624	8.2395	4.3925	Dalian City	2021	2.818	24.1659	12.9655

Source: China Urban Statistics Yearbook (<https://www.stats.gov.cn>)

### 1.3 Problem Statement

In recent years, China’s urban-rural income disparity has been a key driver of national income inequality (Li et al., 2013). This urban-rural gap is the primary factor influencing overall income inequality, accounting for 44% of China’s total income inequality in 1995, rising to 45% in 2002, and peaking at 51% in 2007, before declining to 34% in 2013 (Jain-Chandra et al., 2018; Li et al., 2013). Economic growth makes urban areas more profitable, and the difference in income levels between urban and rural populations becomes obvious (Zhang & Song, 2003).

Despite these economic advancements significantly improving the financial well-being of citizens nationwide, there remains a substantial income disparity between urban and rural populations on a national scale (see Figure 1.2.2). The

income disparity between urban and rural residents is a widespread issue, and even when compared to other countries, China's urban-rural income gap at the national level is notably larger (Knight & Song, 1999; Sicular et al., 2008). According to a report from the Tourism Research Centre, Chinese Academy of Social Sciences, countries like France and Germany had urban-rural income ratios ranging from 1 to 1.25 in 2019, while Spain and Germany fell within the 1.25-1.5 range. In developing nations, Vietnam recorded a ratio of 1.9 in 2014, whereas India's urban-rural income ratio was around 2 (Guo et al., 2022). However, China's ratio has consistently remained above 2.5 since 2000, higher than the international average (Yuan et al., 2020; Sicular, 2007), as shown in Figure 1.2.2.

The results of income gap decomposition show a connection between urban-rural disparities and the significant national income gap in China (Li & Yue, 2004; Tsui, 1993; Hussain et al., 1994; Kanbur & Zhang, 1999; Jain Chandra et al., 2018; Sicular et al., 2008). Therefore, addressing urban-rural inequality at the city level is essential. Analyzing city-level data (refer to Figure 1.2.3), it can be noted that there is a broader income gap between urban and rural areas in cities with lower income levels compared to those in higher-income cities. Moreover, Figure 1.2.3 illustrates that even among cities with the highest per capita income, nearly half of the urban-rural inequality index still is larger than the international warning line of 0.4. Even worse, inequality in cities with lower income levels is more severe than in the most developed cities. In summary, urban-rural income inequality poses a significant challenge to China's sustainable development nationally.

Many factors that may affect urban-rural income inequality have been widely studied, such as urbanization (Todaro, 1969; Harris & Todaro, 1970, Su et al., 2015; Qiu et al., 2021; Yao & Jiang, 2021; Zhong et al., 2022), education (Sicular, et al., 2008; Benjamin et al., 2006; Yuan et al., 2020; Nguyen & Do, 2020), industry structure (Huang et al., 2016; Wu Xiaolong, Liu Zuyun, 2014; Jin et al., 2011; Liu et al., 2017) and the quality of government (Guillamon et al., 2011; Heald, 2003; Mendonça & Esteves, 2018; Adams & Klobodu, 2016). However, the research gap still exists due to the changing economic environment of China's cities, characterized by the impressive role of digitalization in development and the increased openness to trade across the country.

Theoretically, research gaps can be found in theories such as the Kuznets Curve, Dual Sector Model, and Ranis-Fei Model, have provided support for economic development and income inequality. However, when it comes to explaining the impact of digitalization, entrepreneurship, and foreign direct investment on urban-rural income inequality, particularly in the context of cities in China, these theories exhibit limitations. Firstly, the Kuznets Curve, which describes the long-term trend of income inequality during economic development, appears to have overlooked the emerging influences of the new influences of technological advancements (such as digitalization) and global economic integration (such as foreign direct investment) on the pattern of inequality. Secondly, the Dual Sector Model and the Ranis-Fei Model, both emphasizing the structural transformation between the agricultural and non-agricultural sectors, do not address how technological progress affects rural-urban

economic development and inequality. They do not consider the potential new forms of rural-urban dualism brought by digitalization and how this structure may intensify or mitigate inequality by influencing the distribution of entrepreneurial opportunities and foreign direct investment. Lastly, while the Digital Divide Theory highlights disparities in access to and utilization of information technology among different groups, and the Technological Spillover Theory focuses on how technological progress spreads from one sector or region to another, there is a gap in the literature regarding the analysis on cities based on their level of digitalization, extends to lack of the exploration of how entrepreneurship differentially impacts urban-rural income inequality under varying degrees of digitalization, as well as potential moderating factors that may influence the effectiveness of digitalization.

Practically, research gaps can be found as follows: Firstly, many previous studies primarily focus on overall inequality at the national or provincial level, often overlooking the examination of digitalization at the city level and the subgroup analysis of cities to derive more applicable policy recommendations. Secondly, studies often overlook to investigate the impact of entrepreneurship on urban-rural inequality with different levels of digitalization environments. Thirdly, much of the existing research explores the direct impact of digitalization on inequality, but often ignores the limited effectiveness of digitalization in areas where it is low (for example, in low-income areas), and where it may not work best without the help of other factors, such as the potential moderate effect of foreign direct investment is often overlooked by existing research on rural-urban income inequality. Thus, in affirming the importance

of the factors that influence inequality identified in previous research, it is crucial to recognize that there may be other important factors in reducing rural-urban inequality. Given the current research gap, this study identifies three key potential factors: digitalization, entrepreneurship, and foreign direct investment.

The deployment of digital technologies, including the Internet, big data analytics, artificial intelligence, blockchain, and the Internet of Things, has demonstrated substantial effects on fostering innovation and driving economic growth (Zhang et al., 2020; Dong et al., 2021; Luo et al., 2023). Digitalization may bring benefits to residents in rural areas from several aspects. Digital technologies can optimize agricultural production methods and improve agricultural production efficiency (Stupina et al., 2021), besides, the development of digitalization improves the human capital level of rural residents and broadens the traditional education model (Sahu & Samantaray, 2022), which makes people's learning methods more convenient and diversified. Besides, a high digitalization level has improved economic efficiency and entrepreneurial opportunities (Zhai et al., 2022), digital development can also help rural residents participate in market transactions, the high proportion of Internet usage is one of the indicators of digitalization, which makes rural residents have the opportunities to participate in e-commerce and other emerging entrepreneurial activities (Haji, 2021; Zhu et al., 2021) if the government can carry out policies to support the entrepreneurial spirit, it will greatly improve the income level of rural areas. Given that previous research seems to be a strong support for economic growth, there is a lack of literature to support whether digitalization can bring balanced growth

to urban and rural areas in a city. So this study is curious whether increasing digitalization across all cities in China will help reduce urban-rural income inequality?

Entrepreneurship, often hailed as an engine for socio-economic transformation, is also theoretically believed to contribute to the enhancement of regional economic income. Firstly, Fritsch & Mueller (2008) point out that entrepreneurial activities not only directly provide more jobs, but also absorb a large number of rural surplus labor, although entrepreneurship is disruptive to existing jobs (Lewis, 1954), it creates far more new jobs than it replaces. Secondly, entrepreneurship raises the income level of entrepreneurs themselves, thereby reducing the proportion of low-income groups and further reducing the income gap, and entrepreneurship provides high-wage jobs by starting businesses and raises the incomes of low-income earners (Lippmann et al., 2005; Berner et al., 2012). Thirdly, entrepreneurship can be seen as a potential pathway to climb the socioeconomic ladder, as it enables individuals especially those from lower-income or rural backgrounds, to improve their economic standing through self-employment, innovation, and small business creation. Quadrini (1999) finds that entrepreneurs experience greater upward wealth mobility compared to wage earners, highlighting the role of entrepreneurship in promoting intergenerational mobility. Similarly, Lippmann et al. (2005) argue that entrepreneurship offers disadvantaged groups a way to participate in the market economy, while Bruton et al. (2013) emphasize its importance in addressing structural barriers to economic opportunity. These studies support the view that entrepreneurship fosters upward mobility and contributes to reducing inequality. Building on this, entrepreneurship is well