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Research on the development of China's retail industry: Analysis from policy and market forces

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Abstract: Retail markets exists in various forms in China, retailers need non-vicious competition markets, the Darwinian characteristic of a retailer’s departure from population competition is that the losses are greater than the maximum loss that can be borne. The symbiotic relationships are existed in retail markets and multi-industry during a long period. To establish a rational competition ecology, the government needs to provide a fair competition environment for the market, especially in preventing counterfeits. Multi-factor regressions are used from the aspects of policy and market forces, unemployment rate has an inhibiting effect, financial inclusion and transport infrastructure are of promoting effects. Market forces (such as resident income and Internet access scale) play their roles and have promoting effects. Human capital is an important bridge between policy and market forces, brings spillover effects. Heterogeneity varies across regions. Despite the pressure from intense competition and small profits for the retail industry, but the development vision will be better by expectable policies.

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1.Introduction

China's economy has developed rapidly. From 1978 to the present, the economic aggregate has increased by more than 300 times. After years of development, Internet economy already has a strong competitive advantage. The central government has repeatedly stressed that it is necessary to promote the deep integration of the Internet economy and the substantial economy, and support the development of the industrial Internet, and effectively promote the digitalization and intelligence of the manufacturing industry. China's economic development has a good momentum and strong resilience. In order to comply with the overall pattern planning of " economic development of domestic and international dual circulation ", China made full use of the advantages of Internet economy and strengthened the coordinated development of retail industry and foreign trade industry. Although the vitality and momentum of the Chinese economy have been enhancing for a long time, there are still some problems, such as difficulties in production and operation of a small number of enterprises and insufficient consumer demand. In order to enhance the efficiency of economic growth, financial inclusion has been implemented for many years, which has greatly reduced the financing burden of enterprises. Later, the 20th National Congress report in China clearly proposed to "build a national unified large market". The "Outline of the Strategic Plan for Expanding Domestic Demand (2022-2035)" issued in December 2022

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3 further emphasized "promoting the formation of a strong domestic market and focusing on
4 unimpeded domestic economic circulation". Therefore, establishing a modern circulation system
5 and reducing the cost of commodity circulation are facing challenges in promoting the integration
6 of commodity markets.
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10 The retail industry is an important part of the unified large market in China. Scaling up and
11 maintaining vitality are important components of high-quality development in China's retail
12 industry, but there are few empirical articles based on policy and market forces mechanisms in this
13 field. In the course of the development of retail trade market, the historical trade industry has
14 always existed, and the modern free trade theory can be traced back to the British economist
15 Smith (1776), whose research core was that free trade could make both parties be involved in
16 trade gains and trade benefits. Ricardo (1817) created the theory of free trade based on
17 comparative advantage. Smith and Ricardo were outstanding representatives of the classical
18 school of free trade. In the middle of last century, the free trade theory of the modern school was
19 divided into the new factor trade theory and the new international trade theory, who were
20 represented by Heckscher and Ohlin. In the new century, the trade theory or its application
21 issues have been further studied (Anderson et al., 2004; Fujita et al., 2013, Salvatore, 2023).
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30 At present, there is some literature on the studies of retail trade development. The first branch
31 is the influence from inclusive finance. (1) Impacts on international trade. The development of
32 inclusive finance would not only affect the scale of trade from the two aspects of intensive margin
33 and extended margin, but also affect the structure of trade due to the difference in external
34 financing dependence among industries (Fan and Zhang, 2017). The development of inclusive
35 finance was conducive to the development of international trade (Ma et al., 2020; Zhang et al.,
36 2022). Digital inclusive finance would promote the export of enterprises with lower productivity
37 and improve the working capital use efficiency of small and micro enterprises (Zhang et al., 2022).
38 (2) Impacts on trade flows or circulations. Hu and Lu (2021) showed that its development could
39 promote the transformation of enterprises' trade mode, promote the transformation of enterprises
40 to domestic sales, and increase the proportion of domestic sales. Furthermore, digital inclusive
41 finance promoted the development of China's retail trade circulation industry, and this influence
42 had obvious regional differences to a certain extent, with the greatest impact on the eastern region,
43 followed by the central region, and the least impact on the western region (Mei and Bian, 2023).
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52 The second branch is the influence from economic, income and unemployment. (1) Effect of
53 digital economy. Digital economy could promote the high-quality development of commercial
54 circulation industry through technological innovation, the joint agglomeration of manufacturing
55 and commercial circulation industry, and the upgrading of consumption structure (Yang and Xu,
56 2023). The improvement of the development level of digital economy had a significant positive
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spatial spillover effect on the high-quality development of foreign trade (Bao et al., 2023). (2) Effect of economic and trade network structure. Yang and Fu (2022) found that the "Belt and Road" trade network structure had a significant impact on regional economic linkage. Countries with a high degree of network centrality had closer trade exchanges with other countries and a higher degree of economic linkage. In the field of commercial circulation, there was a significant positive correlation between the innovation-driven development and economic growth in China's commerce and circulation industry, and the coupling coordination degree of the two had been on a steady rise (Li and Guo, 2021). (3) Most studies showed income growth could promote the consumption or commercial circulation, but some of the promotion mechanisms were different (Si et al., 2022; Qiao & Xu, 2023; Zhang et al., 2024). Income diversification was an important way for digital financial ability to promote household consumption upgrading (Si et al., 2022). The effect of income growth on consumption upgrading was influenced by the adjustment of distribution structure (Qiao and Xu,2023). The increase of residents' income would promote the upgrading of consumption structure, but the upgrading mode had consumption preference (Zhang et al., 2024). Income growth took labor productivity and labor supply as the core, and played a moderating role in the high-quality development of commercial circulation industry to promote consumption upgrading (He, 2023). (4) Effect of unemployment rate. The more open the level of trade between developed and developing countries, the lower the level of unemployment was (Chen, 2014). Trade had a significant and sustained impact on unemployment, which was reflected in the positive correlation among tariff and import dependence and unemployment, while the increase of non-tariff trade barriers would reduce unemployment (Zhan & Yu, 2016). Whether unemployment necessarily led to a decline in consumption actually depended on a variety of factors, such as a household's ability to borrow, a spouse's labor supply, savings, and social security (Ganong and Noel, 2019; Landais and Spinnewijn, 2021). Unemployment had a small short-term impact on household consumption expenditure, but given that the maximum period of receiving unemployment insurance is 24 months, and household savings and other resources were gradually consumed, it was still necessary to pay great attention to and prevent the risk of long-term household unemployment (Zhao et al., 2024).

The third branch is the influence from Internet. Some literatures concluded that the emergence of the Internet had a positive externality, which promoted the growth of trade and gave birth to new forms of international trade (Freund & Weinhold, 2002; Choi, 2010; Bianchi et al., 2013; Huang et al., 2019). In the field of commercial circulation, Ji and Wang (2020) found that the dual economic structure of urban and rural areas in the field of commercial circulation in China had obvious characteristics, and the use of "Internet plus" new thinking and new technology to integrate and improve the efficiency of urban and rural commercial flow, logistics, information

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4 flow and capital flow, which could promote the integrated and coordinated development of urban
5 and rural commercial circulation. Wang et al. (2023) also showed that digital inclusive finance
6 could promote the improvement of residents' consumption level by promoting the high-quality
7 development of commercial circulation.
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10 From the above literature review, it can be found that there are still research gaps. (1) There
11 are relatively rare literatures on the development mechanisms of retail industry from symbiotic
12 and fair competition perspectives based on government and market. (2) There are relatively rare
13 literatures on the differentiation mechanisms from policy factors, especially in financial inclusion.
14 (3) There are relatively rare literatures on moderating mechanisms from policy and market forces.
15 In particular, the intermediate role of human capital is almost ignored.
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20 Our contributions include: (1) This paper analyzes the competition mechanism on the
21 development of Chinese retailers based policy and market forces. The government provides
22 preferential interest rates, legal and financial services, good transport infrastructure and
23 education, etc, the generally fair competition among Chinese retailers can be guaranteed, but a
24 few monopolies still exist. The market side needs an absolutely fair competition environment
25 and a free entry & exit mechanism to achieve an ecological prosperity. Here, we propose a
26 new view that the Darwinian characteristic of a retailer's departure from population
27 competition is that the losses are greater than the maximum loss that can be borne. (2) This
28 paper addresses the symbiotic mechanism of retail market and examines the impacts of policy
29 and market forces. The existing literatures show that there are symbiotic relationships among
30 retail platform enterprises, third-party payment enterprises and the express enterprises, but
31 there is not enough evidences to show that there is a symbiotic relationship among all
32 participants (retailers), so we reveal the symbiotic relationship in retail markets and
33 multi-industry, and analyze retailers' competition mechanism in retail platform. Most
34 importantly, we also examine policy and market forces, the rise of unemployment rate has an
35 inhibiting effect, while the government provides the service policies of financial inclusion and
36 transport infrastructure (road density) and bring promoting effects. Furthermore, income
37 growth increment and Internet access scale can also bring promoting effects. (3) This paper
38 examines the moderating effects from policy and market forces and confirms the existences of
39 positive spillover effects, especially in financial inclusion and human capital. Chinese
40 government's implementation of financial inclusion can help financing for retailers or improve
41 their developments. Besides, the Chinese government has enhanced the quality of human
42 capital through education, and the latter helps to improve productivity and resident income,
43 etc., which are reflected through the moderating effects. Therefore, the moderating
44 mechanisms from policies and market forces are different of other studies.
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The rest of this study is organized as follows: the section " Research framework, mechanism analysis & research hypothesis " builds the research framework, symbiotic mechanism analysis and puts forward the research hypothesis. The section "Econometric analysis " introduces variables, data and models, and reports and discusses the main results. The section "Conclusions and policy implications" presents the main conclusions and makes relevant suggestions.

2. Research framework, mechanism analysis & research hypothesis

2.1 Research framework

The research framework of this paper is as follows: The development mechanisms of retail industry is selected as the research object, the symbiotic mechanism and competition mechanism will be analyzed theoretically, and influencing mechanism will also be analyzed empirically in detail. For symbiotic mechanism, we analyze it by three types of retail markets. For competition mechanism, the government should provide preferential interest rates, sound law and financial services, good transport infrastructure and education and so on, the retail market participants need a fair competition environment and free entry & exit mechanisms, etc. For influencing mechanism, the key factors will be considered. Just like policy factors (unemployment rate, transport infrastructure and financial inclusion) and market forces factors (income growth increment, Internet access scale, freight turnover scale) are considered. Most notably, human capital acts as an important bridge between policy and market forces, which are analyzed from spillover effects. The research framework is shown in Fig 1.

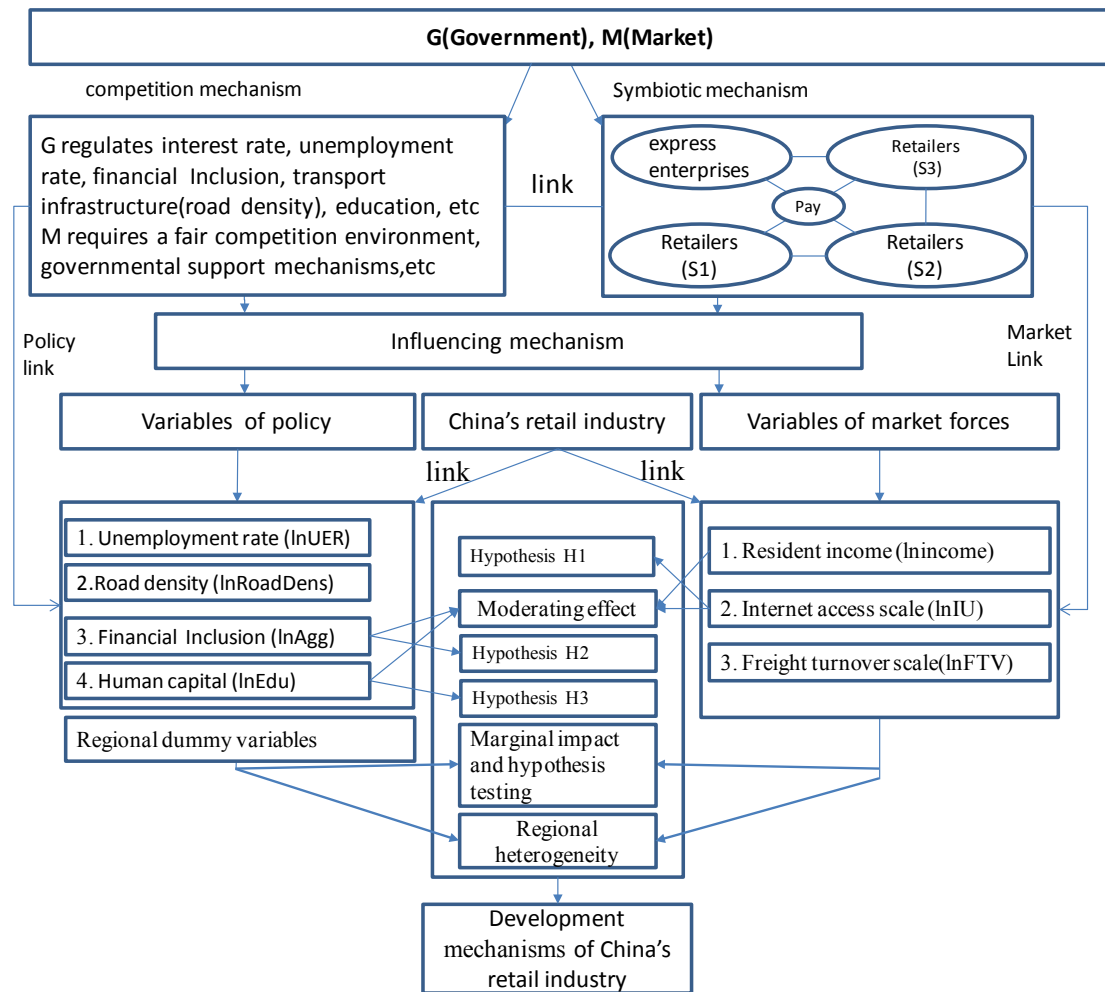


Fig 1. Research framework

Based on the above research framework, this paper continues to discuss the symbiotic and competition mechanism in detail and impacts of each factor on the retail industry in the next part.

2.2 Symbiotic mechanism of markets

2.2.1 Symbiotic relationship in retail markets

China is a major agricultural and industrial country with a rich variety of agricultural products. Its retail business has a history of several thousand years. In recent years, industrial products have been diverse and sold far overseas. From barter in ancient times to transactions using currency in modern times, the retail markets for agricultural products and industrial goods have always existed in various ways. In modern times, there are also several forms of retail markets in China.

(1) Rural retail markets (S1). This is a type of simple markets that still exist in vast towns and townships across China. Take my hometown, Longshi Village in Hengnan County as an example. The fixed market running days open on the 1st, 4th, 7th, 11th, 14th, 17th, 21th,

24th and 27th of each month, with a large flow of people. On other days, the flow of people is very small. In Longshi Village, there is a long street about 1 kilometer long. On both sides of the street are various shops. Many nearby farmers will take the vegetables, fruits and handicrafts they grow to the market to sell in order to earn income and then purchase the industrial consumer goods they want from the shops. Obviously, the existence of rural retail market is also very necessary. When farmers sell their surplus agricultural products, it neither causes waste nor leads to a small income to make up for their household expenses.

(2) Farm product fair retail markets and business districts in cities and towns (S2). Compared with S1, S2 is much larger in scale, and there are also farmers selling agricultural products by themselves around the cities and towns, where have requirements for public image and hygiene, similar rural retail markets are difficult to survive in large cities and towns for a long time. Centers in cities and towns are often several kilometers or dozens of kilometers away from rural areas. Agricultural products, after being purchased in bulk by retailers, begin to appear in vegetable and fruit stores and farm product fair retail markets in cities and towns. In addition, cities and towns also have various enterprises and shops, such as agricultural product processing enterprises, industrial product enterprises, wholesale enterprises, accommodation, catering and logistics enterprises, etc. Some core areas will form business districts and become the calling cards of the places.

(3) Online retail market (S3). It refers to the retail of goods and services realized through public online trading platforms (including self-built websites and third-party platforms). Goods and services include physical goods (such as agricultural products, industrial products, etc.) and non-physical goods (such as virtual goods, service goods, etc.). Nowadays, with the rise of rural e-commerce and express delivery in China, the sale of agricultural products through e-commerce has become increasingly common. New production and sale patterns such as cooperation between e-commerce enterprises and agricultural planting companies and live-streaming sales on the Internet are unfolding. Through efficient logistics, it has become a norm for fresh vegetables and fruits purchased online to appear on the dining tables of urban residents. Industrial products purchased online can be delivered to people's homes promptly, meeting the various daily needs of residents.

As a matter of fact, in China's statistical data, the total retail sales of social commodities cannot precisely calculate the retail sales in rural retail markets. The solution is that in commercial statistics, the total retail sales of social commodities can be classified by industry into commercial retail sales, retail sales of the catering industry, industrial retail sales, etc. Furthermore, there are many forms of statistics on the total retail sales of social commodities, such as statistics by economic type, sales target or commodity category. The existing data in

China have shown that in 2011, the number of wholesale and retail trades had 2276295 entities, rose to 10197183 in 2023. The growth is relatively rapid. If the number of catering services enterprises was added in, the number of legal entities would be even greater. Existing research has shown that there was a strong positive correlation between the income of urban and rural residents and the total retail sales of consumer goods in society. The trends of consumption expenditure of urban and rural residents and the total retail sales of consumer goods in society should be roughly consistent. The growth of consumer goods production will inevitably affect the growth of consumption, and the growth of consumption will also promote the growth of consumer goods production. This paper holds that both agricultural products and industrial products can be traded in the S1, S2 and S3 markets. Therefore, S1, S2 and S3 have a complementary relationship and a symbiotic relationship in China's retail market and commercial trade.

2.2.3 Symbiotic relationship in multi-industry

In multi-industry, there are non-retailers (such as express enterprises, etc.) and retailers in S1, S2 and S3. Some Chinese scholars expressed online retail platform (S3), third-party payment platform and express delivery business as a symbiotic unit (Chen and Luo, 2019). For example, the online retail platform connects the sellers and buyers of the products together, while Alipay and WeChat Pay as the main mediums are used as the third-party payment systems, and many express delivery enterprises are also used as the mediums of transportations.

Chen and Luo (2019) set the actual population density of retail platform, express delivery and third-party payment industries as N_1 , N_2 and N_3 , their symbiotic natural growth rates as R_1 , R_2 and R_3 , and their maximum symbiotic environmental capacities as E_1 , E_2 and E_3 , respectively. According to Logistic equation, the functions of the symbiotic relationship in the three industries are as follows:

$$N_1(t) = E_1(t_{T+1}) / \left\{ 1 + \frac{[E_1(t_{T+1}) - N_1(t_T)]}{N_1(t_T)} e^{-R_1 \Delta t} \right\}$$

$$N_2(t) = E_2(t_{T+1}) / \left\{ 1 + \frac{[E_2(t_{T+1}) - N_2(t_T)]}{N_2(t_T)} e^{-R_2 \Delta t} \right\}$$

$$N_3(t) = E_3(t_{T+1}) / \left\{ 1 + \frac{[E_3(t_{T+1}) - N_3(t_T)]}{N_3(t_T)} e^{-R_3 \Delta t} \right\}$$

Moreover, we have to mention is that the survival situation of retailers is more difficult than before, many retailers in S2 and S3 closed down, an intense competition exists in retail markets. Li et al(2024) also found a mass of retailers exited from the market, regrettably the reasons were not analyzed, but "online ordering, store delivery" instant retail services (new

retail mode) would rise. We think that the main reasons of mass exit for retailers because of operating losses. In recent years, the platform service fee was too high, and rent was also too high from lessors, many retailers have been seeking survival in the cracks. However, we have now discovered some new trends. The prices of commercial properties in China are too high and the vacancy rate is also high. House prices in many places have dropped by 20-30% since 2020. The government has also summoned retail platforms and imposed heavy penalties on monopolistic behaviors. What is nice is that the Chinese government issued stimulus policies to boost consumption, but considering the existing research, retail platform (S3) is a part of this symbiotic relationship, while taking into account the mutual complementarity of the retail markets (S1,S2,S3), according to the multi-level operating mechanism of the Chinese market, it is found that there is a symbiotic relationship between retail industries and retail-related industries, it can also be defined as follows:

$$N(t) = E(t_{T+1}) / \{1 + \frac{[E(t_{T+1}) - N(t_T)]}{N(t_T)} e^{-R\Delta t}\}$$

In the above expression, the actual population density of retailers is N, its symbiotic natural growth rates as R, and its maximum symbiotic environmental capacities as E.

2.3 Retailer’s competition mechanism in retail platform

The paper supposes that the k^{th} retailer sells one kind of commodities (Product i), the price and quantity and cost of each commodity are denoted as p_i^k, q_i^k, c_i^k (p_i^k is also an average selling price), and the revenue is $p_i^k q_i^k$, the cost is $c_i^k q_i^k$, and the profit is $(p_i^k - c_i^k) q_i^k$, the multi-channel competitive behavior of retailer is taking place, shown in Fig 2.

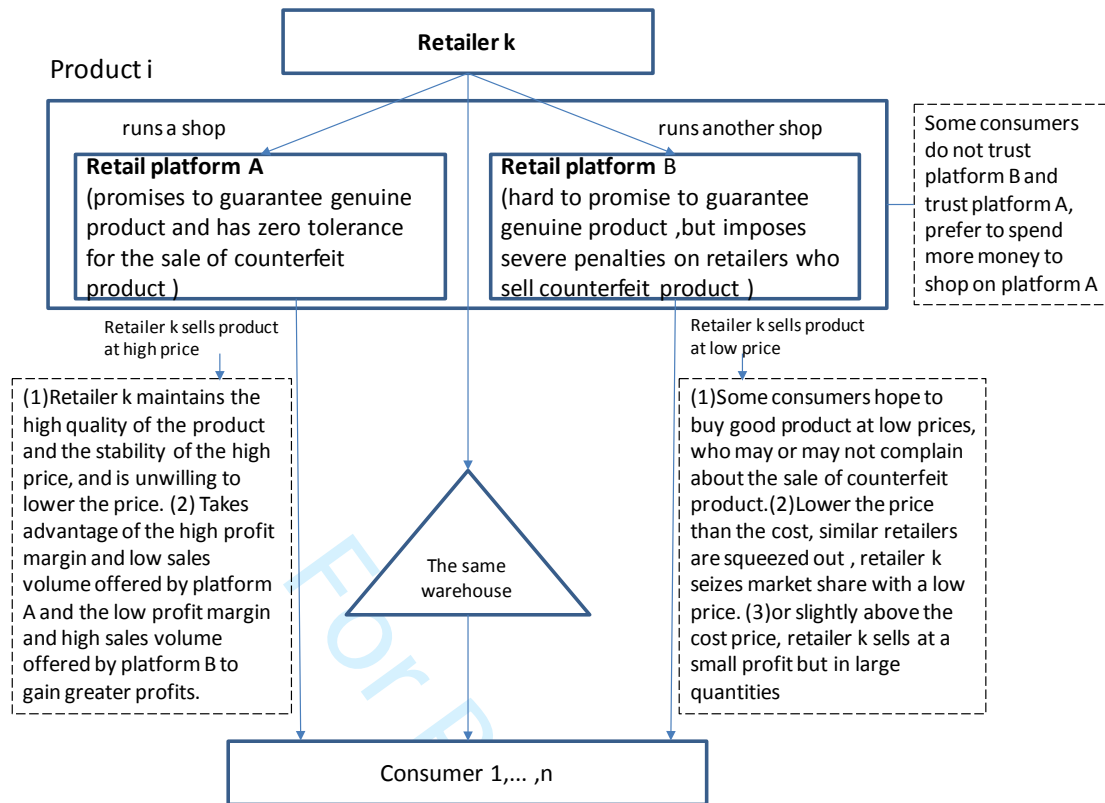


Fig 2. The competitive strategies of retailer

Next, if $(p_i^k - c_i^k)q_i^k < 0$, retailer is facing losses, the paper will continue to explore the exit mechanism of retailer in the platform, the paper assumes that $F_k(t)$ is the fixed cost of the k^{th} retailer to exit in the period t , its higher fixed cost determines the k^{th} retailer to exit, similarly, the j^{th} retailer (competitor) also has a big fixed cost (but less than $F_k(t)$), and also plans to exit. The k^{th} retailer temporarily decides to stay in the platform until the period $t+dt$, at that time, if the j^{th} retailer still will not exit, the k^{th} retailer will exit. Referring to Darwinian selection theory in industry (Tirole, 1997), the paper assumes that only the k^{th} retailer knows that the j^{th} retailer (the competitor) has a probability distribution $g_k(F_j(t))$ regarding fixed cost $F_j(t)$, and assumes g_k that it is defined on intervals $[0, +\infty)$ and is continuous and strictly positive, let $G_k(F_k(t))$ be its cumulative distribution $[G_k(0) = 0, G_k(+\infty) = 1]$.

According to Tirole's research(1997), the paper assumes the conditional probability of the fixed cost of the j^{th} retailer in a rang of $[F_j(t+dt), F_j(t)]$ is $\frac{g_k(F_j(t))}{G_j(F_j(t))}[-F_j'(t)dt]$.

The loss per unit time of the k^{th} retailer is $\frac{-g_k(F_j(t))F_j'(t)}{G_j(F_j(t))}(\frac{F_k(0)-F_k(t)}{r})$, where r is

the bank interest rate. When $\int_0^T \frac{-g_k(F_j(t))F_j'(t)}{G_j(F_j(t))}(\frac{F_k(0)-F_k(t)}{r})dt$ is greater than L ,

which is the sum of sales losses and fixed costs, $L = (|p_i^k - c_i^k|)q_i^k + \int_0^T F_k(t)dt$, $p_i^k < c_i^k$.

Under fair competition environment and free entry & exit mechanisms, when the total new loss of the k^{th} retailer is greater than the maximum loss (L) that can be borne, the k^{th} retailer exits.

Wholesale and Retail Trades had 10197183 entities (WRTEs) in 2023, China has a population of 1.4 billion, with an average of about 1/73 WRTE per person. This means there are too many WRTEs, and competition is inevitable. Although there is vicious competition in competitive means, the retailers that can survive and develop all have their strengths and ways of survival. To avoid a vicious competition, the government needs to establish and maintain a good market mechanism and order, counterfeits should be prohibited and monopolistic operations should be severely punished.

2.4 Research hypothesis

(1) Internet access scale. User is an important part of Internet economy. The larger of its scale, the more Internet users participate in online business. It has not only promoted the increase of traditional e-commerce transactions per capita, but also generated new types of business activities (such as mobile phone shopping, live-streaming sales), attracting more and more people to engage in the Internet business. At the aspect of Internet use, there was a significant correlation between it and labor income, and Internet use promoted wage growth (Wang et al., 2022). Therefore, hypothesis H1 is proposed: Internet access scale lays a foundation Internet business, which is conducive to the development of retail industry.

(2) Financial inclusion. The development of financial inclusion has improved the coverage of financial services, reduced the degree of financial exclusion, and enabled middle and low-income groups, small and micro enterprises and start-ups to obtain more financial support. More and more financial inclusion inputs help enhance the development of commerce and trade industry (Mei and Bian, 2023). In China, financial inclusion is an important policy tool, more inputs of financial inclusion loan can help enhance the service or operation level in retail industry.

The most important point is that the labor productivity and risk resistance capacity of retailers will be enhanced under support of financial inclusion inputs. Hypothesis H2 is proposed: the retailers get financial support to overcome difficulties and enhance developments, which shows that financial inclusion will be conducive to the development of retail industry.

(3) Human capital. Since China's reform and opening up in 1978, it has begun to pay attention to education, and the nine-year compulsory education was implemented in 1986. Later, China began to expand university enrollment in the late 1990s, more students have the opportunity to enter universities to receive higher education. Undoubtedly, Chinese government has enhanced the quality of human capital through education, and the latter helps to improve productivity. However, most studies ignored the intermediate role of human capital, therefore, we propose the hypothesis H3: Human capital acts as a bridge between policy and market forces, which is conducive to the development of retail industry.

Next, this paper continues to in-depth analyze the influencing mechanisms in econometric analysis, especially in differentiation policy and market forces and their moderating effects.

3. Econometric analysis

3.1 Description of variables

The types and descriptions of variables are shown in the following Table 1.

Table 1. Variable types and descriptions

Classification of variables	Variable Description	Variable symbol	Raw data in each province
Development of retail industry	Development of retail industry	RS	Actual value of per capita retail sales of consumer goods (unit: 10,000 yuan per capita)
Policy variables	Unemployment rate	UER	Unemployment rate, calculated from the number of registered unemployed persons in urban areas/employed persons in urban units. (unit: %)
	Transport infrastructure	RoadDens	Road density (unit: hundred Kilometers/Ten thousand square kilometers)
	Financial Inclusion	Agg	Index_aggregate of digital finance (unit: %)
	Human capital	Edu	Education Level (unit: years)
Market forces variables	Resident Income	Income	Actual value of per capita resident income in each province (unit: yuan per capita)
	Freight turnover scale	FTV	Per capita freight turnover volume (unit: 10,000-ton-kilometer per capita)

	Internet access scale (Internet Users)	IU	Per capita Broadband subscribers of Internet by province (unit: one subscriber per hundred people)
Dummy variable	Eastern region variable	<i>East</i>	Dummy variable, It is 1 for the eastern provinces and 0 for the other provinces
	Central region variable	<i>Central</i>	Dummy variable, It is 1 for the central provinces and 0 for the other provinces
	Western region variable	<i>West</i>	Dummy variable, It is 1 for the western provinces and 0 for the other provinces

3.2 Data source and descriptive statistics

The data selected in this paper are from the China Statistical Yearbook and the Peking University Digital Inclusive Finance Index. Due to the short release time of data, only panel data from 2011 to 2021 can be obtained, and all data include a total of 341 samples from 31 provinces and municipalities in Chinese mainland. In order to eliminate possible heteroscedasticity in the following models, logarithmic processing is carried out on all variables, so each model is a logarithmic econometric model. Descriptive statistics of variables is shown in Table 2.

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
lnRS	341	0.560282	0.464282	-0.619	1.764
lnUER	341	1.607451	0.477244	-0.067	2.433
lnRoadDens	341	4.263039	0.868775	1.636	5.409
lnAgg	341	5.275745	0.676714	2.786	6.129
lnincome	341	9.891028	0.393236	8.924	11.046
lnFTV	341	-0.006469	0.741512	-2.044	2.617
lniu	341	2.981358	0.513969	1.421	3.869
lnedu	341	2.207177	0.134814	1.440	2.540
East	341	0.354839	0.479168	0	1
Central	341	0.258065	0.438213	0	1
West	341	0.387097	0.487802	0	1

The empirical regression uses the panel data for analysis. Keeping all variables without missing data, 341 effective observations were obtained. A total of 31 provincial-level regions (Province or municipality) in Chinese mainland.

3.3 Regression models and analysis

3.3.1 Effects from policy and market forces

Here, we use the FGLS method (Feasible generalized least squares method) to estimate the following equations. Model I and II are constructed as follows:

$$\ln RS_{it} = \alpha + \beta_1 \ln UER_{it} + \beta_2 \ln RoadDens_{it} + \beta_3 \Delta \ln Income_{it} + \beta_4 \ln FTV_{it} + \beta_5 \ln IU_{it} + \phi Dummy_{it} + u_{it} \quad (\text{Model I})$$

$$\ln RS_{it} = \alpha + \beta_1 \ln UER_{it} + \beta_2 \ln RoadDens_{it} + \beta_3 \Delta \ln Income_{it} + \beta_4 \ln FTV_{it} + \beta_5 \ln Income_{it} * \ln IU_{it} + \phi Dummy_{it} + u_{it} \quad (\text{Model II})$$

In the above econometric models, first, let's temporarily forget about financial inclusion, because we want to examine the impacts of policy and market forces in the absence of financial inclusion support. Second, other independent variables are added to the model successively and used to test their influences on the development of retail industry. Dummy variables include Central and West, all of which are regional control variables. The regression results are shown in Table 3.

Table 3. Effect from policy and market forces

Coefficient & statistics info	Model I (FGLS)	Model II (FGLS)
lnUER	-0.080***(-5.70)	-0.088***(-7.70)
lnRoadDens	0.173***(-4.80)	0.179***(-4.86)
D(lnincome)	1.004***(-5.67)	0.879***(-7.04)
lnFTV	0.056***(-5.30)	0.041***(-4.61)
lnIU	0.32***(-12.49)	
lnincome*lnIU		0.031***(-11.27)
Central	-0.274***(-4.33)	-0.207***(-3.96)
West	-0.336***(-3.94)	-0.225***(-2.43)
Constant	-0.846***(-4.10)	-0.91***(-4.11)
Number of obs	310	310
Wald test	1405.23***	1805.56***

Note: Values in brackets are z-statistics; ***, ** and * indicate significance levels of 1%, 5% and 10%, similar in the following tables.

In the above Table 3, the results in model I show that policy factors are effective. Unemployment rate has an inhibitory effect, indicates that its rise is not conducive to the development of retail industry. Due to the slowdown in the actual utilization of foreign investment and industrial transformation and upgrading, intelligent manufacturing and production have gradually increased the unemployment of labor in the Chinese market, so the rise in unemployment has restricted the development of China's retail industry. Road density

indicates the scale of the transport infrastructure and has been mainly constructed by the Chinese government, which plays a promoting role. In the aspect of market forces factors, income growth increment, freight turnover scale and Internet access scale have promoting effects, the hypothesis H1 is verified. The reasons are that Chinese residents' income has generally risen, the strong road and freight economy has benefited the flow of retail trade, and the scale of billions of people with Internet access has promoted the development of China's retail industry. Specifically speaking, the rise of Chinese residents' income forms direct purchasing power, the high density of roads gradually forms an efficient economic circle, and the huge population with Internet access constitutes a huge e-commerce consumer market, all of these have been driving the positive development of the retail industry.

3.3.2 Effects from new-added financial inclusion

By further adding the indicator of financial inclusion, the Model III and IV are constructed as follows:

$$\begin{aligned} \ln RS_{it} &= \alpha + \beta_1 \ln UER_{it} + \beta_2 \ln RoadDens_{it} + \beta_3 \ln Agg_{it} + \beta_4 \Delta \ln Income_{it} \\ &+ \beta_5 \ln FTV_{it} + \beta_6 \ln IU_{it} + \phi Dummy_{it} + u_{it} \quad (\text{Model III}) \\ \ln RS_{it} &= \alpha + \beta_1 \ln UER_{it} + \beta_2 \ln RoadDens_{it} + \beta_3 \ln Agg_{it} + \beta_4 \Delta \ln Income_{it} \\ &+ \beta_5 \ln FTV_{it} + \beta_6 \ln Income_{it} * \ln IU_{it} + \phi Dummy_{it} + u_{it} \quad (\text{Model IV}) \end{aligned}$$

The regression results are shown in Table 4.

Table 4. Effect from new-added financial inclusion

Coefficient & statistics info	Model III (FGLS)	Model IV (FGLS)
lnUER	-0.06***(-6.38)	-0.059***(-4.42)
lnRoadDens	0.123***(4.27)	0.127***(4.90)
lnAgg	0.249*** (8.02)	0.215*** (6.79)
D(lnincome)	1.160*** (7.00)	1.047*** (6.00)
lnFTV	0.05*** (5.68)	0.038*** (5.61)
lnIU	0.166*** (5.27)	
lnIncome*lnIU		0.019*** (5.47)
Central	-0.267***(-6.35)	-0.243***(-9.46)
West	-0.324***(-10.02)	-0.325***(-8.43)

Constant	-1.582***(-8.19)	-1.514***(-8.39)
Number of obs	310	310
Wald test	869.35***	1118.61***

In the above Table 4, the results in Model III and IV show that financial inclusion has a promoting effect, the hypothesis H2 is verified. It shows that the Chinese government has achieved a progress in developing the retail industry through the policy implementation of financial inclusion. The reasons lie in the gradual improvement of the financial inclusion system, the wide range of radiation and real help for business owners and individual consumers, while the retail industry is getting a more obvious benefit and a significant promotion effect from financial inclusion.

3.3.3 Spillover effects from policy –human capital- market forces

The development of retail trade on the Internet has better facilitated business exchanges and cooperations, it is also the cornerstone of digital China's development. Therefore, it is necessary to consider the cross terms between human capital and other variables to entry into the model V, shown as follows.

$$\ln RS_{it} = \alpha + \beta_1 \ln UER_{it} + \beta_2 \ln RoadDens_{it} + \beta_3 \ln Agg_{it} + \beta_4 \Delta \ln Income_{it} + \beta_5 \ln FTV_{it} + \phi cross - terms_{it} + \phi Dummy_{it} + u_{it} \quad (\text{Model V})$$

The estimation results are in Table 5.

Table 5. Spillover effects from policy –human capital- market forces

Coefficient & statistics info	Model V (FGLS estimation)	Model V (FGLS estimation)	Model V (FGLS estimation)
lnUER	-0.052***(-5.00)	-0.041***(-2.83)	-0.05***(-3.59)
lnRoadDens	0.14***(4.74)	0.106***(4.48)	0.119***(4.00)
lnAgg	0.19***(6.46)	0.239***(9.84)	0.249***(7.94)
D(lnincome)	1.39***(10.82)	1.261***(8.37)	1.085***(6.06)
lnFTV	0.044***(5.01)	0.02***(2.13)	0.04*** (5.22)
lnAgg*lnedu	0.061*** (7.73)		
lnIncome*lnedu		0.07*** (9.65)	
lnIU*lnedu			0.067*** (4.33)
Central	-0.284***(-6.16)	-0.218***(-7.57)	-0.267***(-9.09)
West	-0.311***(-6.42)	-0.236***(-4.34)	-0.352***(-7.58)
Constant	-1.594***(-10.14)	-2.56***(-15.80)	-1.527***(-7.66)

Number of obs	310	310	310
Wald test	1257.45***	737.68***	860.84***

Human capital is a policy variable, and its improvement means that the overall level of China's education rises, which is an intellectual support for China's modernization. In Table 5, we design three cross terms, which are $\ln\text{Agg}*\ln\text{edu}$, $\ln\text{Income}*\ln\text{edu}$ and $\ln\text{IU}*\ln\text{edu}$. Why focus on human capital? This is because the development of human capital means the enhancement of education quality. Its rise means an increase in productivity and labor reward, which in turn increases the business or consumption of retail market. Therefore, the cross-term $\ln\text{Agg}*\ln\text{edu}$ indicates that the synergistic effect between financial inclusion and human capital can further enhance the development of retail market, while the cross-term $\ln\text{Income}*\ln\text{edu}$ indicates that the synergistic effect between resident income and human capital can help increase the expenditure of retail trade. The last cross-item $\ln\text{IU}*\ln\text{edu}$ means that the collaborative development between Internet access scale and human capital has expanded the business space of e-commerce. In addition to traditional e-commerce, knowledge payment types of business activities are also rising. In Table 5, all cross terms have significant positive spillover effects, the hypothesis H3 is verified, which show that the synergies of human capital with policy and market forces further promote the development of China's retail industry.

3.3.4 Robustness test

In order to examine the endogeneity and robustness of the models, we re-examine the models with different methods, adding and subtracting variables. Considering the possible delay differences in the policy delivery mechanism of financial inclusion, another GMM method (Generalized method of moments) is used, and the results are shown in Table 6 and Table 7.

Table 6. Robustness test of all policy and market factors

Coefficient & statistics info	Model III (GMM)	Model IV (GMM)
$\ln\text{UER}$	-0.194***(-4.76)	-0.179***(-4.66)
$\ln\text{RoadDens}$	0.126*** (5.68)	0.119*** (5.32)
$\ln\text{Agg}$	0.278*** (2.79)	0.111 (1.13)
$D(\ln\text{income})$	2.170** (2.28)	2.420*** (2.61)
$\ln\text{FTV}$	0.059* (1.92)	0.040 (1.39)
$\ln\text{IU}$	0.235*** (2.93)	

lnIncome*lnIU		0.038*** (5.34)
Central	-0.18*** (-3.67)	-0.134*** (-2.73)
West	-0.26*** (-4.89)	-0.212*** (-4.04)
Constant	-1.864*** (-4.65)	-1.428*** (-3.55)
Number of obs	310	310
R-squared	0.6766	0.7050
Wald test	520.95***	604.49***
Instrument variable	L.lnAgg	L.lnAgg

Table 7. Robustness test of Spillover effects

Coefficient & statistics info	Model V (GMM estimation)	Model V (GMM estimation)	Model V (GMM estimation)
lnUER	-0.181*** (-5.28)	-0.154*** (-5.00)	-0.185*** (-4.94)
lnRoadDens	0.092*** (3.55)	0.075*** (2.96)	0.108*** (4.49)
lnAgg	0.210* (1.88)	0.401*** (6.80)	0.255*** (2.91)
D(lnincome)	3.031*** (2.90)	3.403*** (3.25)	2.789*** (2.84)
lnFTV	0.041 (1.52)	0.016 (0.70)	0.043 (1.46)
lnAgg*lnedu	0.127*** (3.21)		
lnIncome*lnedu		0.086*** (5.55)	
lnIU*lnedu			0.120*** (3.89)
Central	-0.200*** (-4.38)	-0.152*** (-3.34)	-0.171*** (-3.57)
West	-0.256*** (-4.79)	-0.193*** (-3.51)	-0.241*** (-4.58)
Constant	-2.24*** (-6.17)	-3.684*** (-8.33)	-1.83*** (-4.79)
Number of obs	310	310	310
R-squared	0.6837	0.7241	0.6896
Wald test	527.37***	685.46***	515.75***
Instrument variable	L.lnAgg	L.lnAgg	L.lnAgg

According to Table 6 to Table 7, the results of GMM method and FGLS method are almost consistent. In the GMM method, the variable of freight turnover scale fails to pass the significance test because of the interaction with policy and market forces. The multi-dimensional influences of various policy forces are obviously dominant, a part of market forces (such as freight turnover scale) is obviously affected by extrusion, while the income effect is always significant. This is consistent with the reality in China, where income

is the key market force and irreplaceable.

4. Conclusions and policy implications

The main conclusions of this paper are as follows:

(1) In terms of policy mechanisms, undoubtedly, the rise in unemployment rate will also inhibit the growth of China's retail industry, which is validated by our analysis. But road density has a positive effect, which indicates good transport infrastructure can promote the development of retail industry. Financial inclusion policy plays an important role, it has been implemented many years in China, whose effect has been beyond expectation. First, the Chinese government needs a strong retail sector to meet the growing demands of material and cultural life of people. Second, the retail industry involves a large number of enterprises and individuals, and the number of beneficiaries of financial inclusion in China can theoretically reach hundreds of millions people, which has a far-reaching impact on China's development. Various financial inclusion indicators are conducive to fully releasing the financial service mechanism. Such as, the financial institutions provide credit loans to many retailers and self-employed individuals, many retail activities can be completed by mobile electronic devices, in which the time of waiting is reduced, it is conducive to the improvement of commercial circulation efficiency. Financial insurance companies provide insurance protections for retail businesses, which can stabilize and promote the healthy development of China's retail industry.

(2) In terms of market forces mechanisms, the rises of resident income and Internet access scale have significant positive effects, which are also conducive to the development of retail industry. Many delivery networks of goods in the retail industry have changed from the integration to the separation of deal and physical distribution, in which Internet has played an important role and produced out the rapid development of various types of e-commerce. Online per capita e-commerce transaction amount of 30,000 yuan in 2021 was a strong proof of the development of China's retail industry. Internet has been an important support for the development of e-commerce and China's retail industry, it will continue to be an important business channel in the future.

(3) The cross-terms between human capital and policy- market forces factors (financial inclusion, resident income and Internet access scale) respectively show a positive spillover effect, which shows that the synergistic effect is effective between human capital and policy factor, as well as between human capital and market forces factor. The construction of high-quality human capital will be more competitive in each industry and more beneficial to retail industry.

(4) Regional heterogeneity exists. The retail industry in the eastern region develops better,

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3 followed by the central region and then the western region. This is closely related to the
4 development of economic and regional advantages. The eastern region is a coastal region with
5 obvious advantages in economy, transportation and geography, which determines the
6 development of retail industry has been becoming better from the west to the east.
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10 Through the researches of this paper, the paper also suggests that the Chinese government:

11 (1) Accelerate the development of a national unified large market and retail industry,
12 continue to improve the coverage of financial inclusion, Internet and economic development. In
13 China, the phenomenon of regional imbalance in the development of retail industry still exists.
14 Local governments should give classified measures to further enhance the activities of retail, and
15 explore and improve the new development mode of retail. Local governments should continue to
16 improve the coverage of financial inclusion, reduce financing costs for retail, and strengthen
17 competitive advantages. With the support of Internet, the retail activities can be interconnected
18 and the economic systems can be connected closely. Local governments should give policy
19 support in guiding and helping retailers to grow bigger and stronger, the monopoly operation of
20 platform enterprises should be given heavy penalties and competitive ecology should be
21 ensured.
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29 (2) Implement a high level of opening to the outside world, reduce unemployment rate and
30 develop high-quality commercial circulation industry. In the past ten years, China's economy has
31 benefited from the rapid development of domestic and foreign trade, the unemployment rate has
32 risen gradually. As China's economic market is becoming more and more open, the market
33 economy has become dominant. In order to adapt to the changes in the environment and the
34 development pattern of the world economy, the central government has issued a series of policies
35 in controlling unemployment rate, proposed to implement a high-level opening to the outside
36 world and build a new system of an open economy at a higher level, so as to further promote the
37 new growth of the economy in both quality and quantity. Local governments should implement a
38 high level of opening up according to local resources and circumstances, promote employment
39 and enhance high-quality development of trade and circulation industry, so as to boost the
40 economy and stimulate market vitality and achieve the economic development of domestic and
41 international dual circulation.
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50 (3) Accelerate the development of road and railway networks, continue to increase the
51 density of road and railway networks, improve the construction of digital infrastructure. China's
52 road network and rail network have different service coverage, management and planning
53 differences, can serve the retail industry together. It is suggested that China continue to enhance
54 the construction of road and railway network density, accelerate the development of economy and
55 retail industry, and strengthen the coordination of digital infrastructure constructions to further
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enhance the development and prosperity of retail industry.

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Data availability

Data used in this study are available from the corresponding author at reasonable request. The Data can also be downloaded from the website <https://data.stats.gov.cn/>, and the Digital Financial Inclusion Index can also be obtained from Institute of Digital Finance Peking University(<https://www.idf.pku.edu.cn/index.htm>).

References

- [1] Smith A.. “Wealth of Nations”. (Gao G. tr, 1rd edn, *Beijing:China Industry and Commerce Associated Press,2017*) (in Chinese)
- [2]Ricardo D.. “Political Economy and Principles of Taxation”.(Guo D.L. and Wang Y.N tr, 3rd edn, *Beijing:The Commercial Press, 2021*) (in Chinese)
- [3]Anderson J. E., Wincoop E. V. “Trade Costs”(2004). *Journal of Economic Literature*,Vol.42, No.3, pp. 691-751.
- [4]Fujita M. , Thisse J. F. “Economics of Agglomeration: Cities, Industrial Location and Globalization”. (2rd edn, *Cambridge: Cambridge University Press, 2013*) .
- [5]Salvatore Dominick. A simultaneous equations model of the relationship between international trade, and economic growth and development with dynamic policy simulations. *Journal of Policy Modeling*. Volume 45, Issue 4, July–August 2023, Pages 789-805. <https://doi.org/10.1016/j.jpolmod.2023.06.010>
- [6]Fan Z. B., Zhang L.Q. “The effects of financial inclusion development on trade margin and structure in China”(2017). *The Journal of Quantitative & Technical Economics*, Vol 34, No.9, pp.57-74. (in Chinese)
- [7]MA D.G., LUO Y.K., ZHANG Y. “Inclusive Finance and International Trade——A Study Based on the Experience of 36 Countries” (2020)., *Chinese Review of Financial Studies*, Vol.12, No.2, pp.98-110. (in Chinese)
- [8]Zhang P.Y., He Z.Y., Zhang S. et al. “Study on the impact of digital Finance on import trade: Based on the perspective of stimulating Domestic Consumption Demand”(2022). *Contemporary Economic Research*, No.8, pp.115-128. (in Chinese)
- [9]Zhang M.X., Xie S.X., Qiang H.F. et al. “Digital Financial Inclusion and Export of SMEs: Timely Help or Additional Improvement”(2022), *The Journal of World Economy*, Vol.45, No.1, pp. 30-56. (in Chinese)
- [10]Hu S., Lu J.K. “Digital inclusive finance, trade mode transformation and enterprise markup

- rate”(2021).*Social Sciences in Guangdong*. No.6, pp.41-50. (in Chinese)
- [11]Mei Y., Bian L.N. “The effect of digital inclusive finance on the development of commercial circulation and its regional heterogeneity”(2023), *Business Economics Research*. No.9, pp. 26-29. (in Chinese)
- [12]Yang Renfa, Xu Xiaoxia. The impact of digital economy on the high-quality development of commercial and trade circulation industry[J]. *China Business and Market*. 2023,37(05) : 28-40.
- [13]BAO Z.S., HAN J., WENG M. et al. “How Does Digital Economy Promote High — quality Development of Foreign Trade” (2023), *International economic and trade research*. Vol.39, No.2,pp. 4-20. (in Chinese)
- [14]Yang J. J., Fu J. “Trade Network Topology of Regions along ‘the Belt and Road’ and Its Impact on Economic Linkage” (2022), *Social Sciences in Nanjing*, No.11, pp. 42-50. (in Chinese)
- [15]Li J.K., Guo H. “Evaluation on the coupling relationship between innovation and development of China's commercial circulation industry and economic growth” (2021). *Macroeconomics*, No.5, pp. 69-80. (in Chinese)
- [16]SI Chuan-ning, LI Ya-hong, SUN Le. Digital Financial Capabilities, Income Diversification and Household Consumption Upgrading. *CONSUMER ECONOMICS* . 2022 ,38 (06):71-80.
- [17] Qiao Zhen, Xu Hongxin. Household income growth, distribution structure and consumption upgrading: An analysis based on China's experience. *Social Science Front*. 2023 (01):63-72.
- [18] Zhang Yishan, Qin Yingying, Wang Haoyu. The change trend of residents' consumption structure and the effect of industrial income distribution. *Social Science Front*. 2024 (05) :76-88.
- [19]He Li. The impact of high-quality development of commercial circulation Industry on consumption upgrading: the moderating role of income growth.] *Journal of Commercial Economics* 2023 (13): 19-22
- [20] Chen M. The impact of trade liberalization on total unemployment: A case study of trade between developed and developing countries. *Current Economics*, 21 (2014) :9-13.
- [21]Zhan hua, Yu jinping. Trade policy, expansion of imports and unemployment. *World Economic Papers*. 2016 (1) :52-67.
- [22]Ganong P, Noel P. Consumer spending during unemployment: Positive and normative implications[J]. *American Economic Review*, 2019, 109 (7): 2383 – 2424.
- [23]Landais C, Spinnewijn J. The value of unemployment insurance[J]. *The Review of Economic Studies*, 2021, 88 (6): 3041 – 3085.

- [24]Zhao Da, Guo Jingyuan, Song Ze. How will Unemployment Affect Household Consumption in Urban China? *Journal of Shanghai University of Finance and Economics*. 2024,26(4):92-106.
- [25]Freund C., Weinhold D. “The Internet and International Trade in Services”(2002). *American Economy Review*, Vol.92, No.2, pp.236-240.
- [26]Choi, C. “The Effect of the Internet on Service Trade”(2010), *Economics Letter* , Vol.109, No.2, pp.102-104.
- [27]Bianchi C., Mathews S.W. “The role of the Internet on export market growth: An empirical study in Latin America”(2013). *IEEE Transactions on Control Systems Technology*, Vol.21, No.6, pp.2323-2331.
- [28]Huang X., Song X. “Internet use and export upgrading: Firm-level evidence from China”(2019). *Review of International Economics*, Vol.27, No.4, pp.1126-1147.
- [29]JI L.G., WANG J.H. “Research on the Integration Mode of Urban and Rural Commercial Circulation Under the Background of Internet plus ” (2020), *ECONOMY AND MANAGEMENT*, Vol.34, No.2, pp. 77-84. (in Chinese)
- [30] Wang Min, Zhang Bowen, Xu Yu. Digital inclusive finance and Household Consumption: Intermediary Role based on high-quality development of commercial circulation [J]. *Journal of Xi 'an Shiyou University (Social Science Edition)*. 2023,32(03) : 28-36.
- [31]Chen Jianyi, Luo Shaoqiang. Discussion on the symbiotic relationship between online retail, express delivery and third-party payment industries in China. *Journal of Commercial Economics*, 2019(18):84-87.
- [32]Li Zonghuo, Li Shanliang, Chen Xiangfeng, Hu Miao. The Introduction Strategy of Instant Retail for a Platform Supply Chain Considering Consumer Time Valuation. *Chinese Journal of Management Science*. 2024,32(7):225-235.
- [33]Tirole J. “Theory of Industrial organization”(Zhang W.Y. et al. translated, 1rd edition version), *Beijing: China People's Publishing House*(in Chinese, 1997)
- [34]Wang SG, Kuang GJ (2022) Internet use, skills heterogeneity and wage income: an empirical analysis based on CGSS data. *Seeking Truth* 4:88-102.
<https://doi.org/10.19667/j.cnki.cn23-1070/c.2022.04.009>

Table S3-1. Effect from policy and market forces(1)

```
. xtglm lnrs lnuer lnroadbes d(lnincome) lnftv lnui central west, panels(cor) corr(ar1)
```

Cross-sectional time-series FGLS regression

Coefficients: **generalized least squares**

Panels: **heteroskedastic with cross-sectional correlation**

Correlation: **common AR(1) coefficient for all panels (0.8903)**

Estimated covariances	=	496	Number of obs	=	310
Estimated autocorrelations	=	1	Number of groups	=	31
Estimated coefficients	=	8	Time periods	=	10
			wald chi2(7)	=	1405.23
			Prob > chi2	=	0.0000

lnrs	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lnuer	-.0804839	.0141179	-5.70	0.000	-.1081544	-.0528134
lnroadbes	.1727824	.0359857	4.80	0.000	.1022517	.243313
lnincome d1.	1.003863	.1769508	5.67	0.000	.6570456	1.35068
lnftv	.0564034	.0106514	5.30	0.000	.035527	.0772798
lnui	.319741	.0256087	12.49	0.000	.269549	.3699331
central	-.2744938	.0634279	-4.33	0.000	-.3988103	-.1501773
west	-.33603	.0852893	-3.94	0.000	-.503194	-.168866
_cons	-.8457431	.2061614	-4.10	0.000	-1.249812	-.441674

Table S3-2. Effect from policy and market forces(2)

```
. xtglm lnrs lnuer lnroadbes d(lnincome) lnftv lnincome_iu central west, panels(cor) corr(ar1)
```

Cross-sectional time-series FGLS regression

Coefficients: **generalized least squares**

Panels: **heteroskedastic with cross-sectional correlation**

Correlation: **common AR(1) coefficient for all panels (0.8521)**

Estimated covariances	=	496	Number of obs	=	310
Estimated autocorrelations	=	1	Number of groups	=	31
Estimated coefficients	=	8	Time periods	=	10
			wald chi2(7)	=	1805.56
			Prob > chi2	=	0.0000

lnrs	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lnuer	-.0884582	.0114835	-7.70	0.000	-.1109655	-.0659509
lnroadbes	.1788878	.0368205	4.86	0.000	.106721	.2510545
lnincome d1.	.8788875	.12488	7.04	0.000	.6341271	1.123648
lnftv	.0409594	.0088806	4.61	0.000	.0235538	.058365
lnincome_iu	.0312302	.0027714	11.27	0.000	.0257984	.036662
central	-.2068297	.0522124	-3.96	0.000	-.3091641	-.1044952
west	-.2252195	.0925561	-2.43	0.015	-.4066262	-.0438128
_cons	-.9096245	.221208	-4.11	0.000	-1.343184	-.4760649

Table S4-1. Effect from new-added financial inclusion(1)

```
. xtglm lnrs lnuer lnRoadDes lnagg D(lnincome) lnftv lnui central west, panels(cor) corr(ar1)
Cross-sectional time-series FGLS regression
Coefficients: generalized least squares
Panels: heteroskedastic with cross-sectional correlation
Correlation: common AR(1) coefficient for all panels (0.8919)
Estimated covariances = 496 Number of obs = 310
Estimated autocorrelations = 1 Number of groups = 31
Estimated coefficients = 9 Time periods = 10
wald chi2(8) = 869.35
Prob > chi2 = 0.0000
```

lnrs	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lnuer	-.0599004	.0093933	-6.38	0.000	-.0783109	-.0414898
lnRoadDes	.1228082	.0287493	4.27	0.000	.0664605	.1791558
lnagg	.2486133	.0309869	8.02	0.000	.1878801	.3093464
lnincome D1.	1.160373	.1656674	7.00	0.000	.8356709	1.485075
lnftv	.0496994	.0087509	5.68	0.000	.0325479	.0668509
lnui	.1658763	.0314925	5.27	0.000	.104152	.2276005
central	-.2668807	.0420583	-6.35	0.000	-.3493134	-.1844479
west	-.3235096	.0322814	-10.02	0.000	-.38678	-.2602391
_cons	-1.581694	.1931787	-8.19	0.000	-1.960317	-1.20307

Table S4-2. Effect from new-added financial inclusion(2)

```
. xtglm lnrs lnuer lnRoadDes lnagg D(lnincome) lnftv lnincome_iu central west, panels(cor) corr(ar1)
Cross-sectional time-series FGLS regression
Coefficients: generalized least squares
Panels: heteroskedastic with cross-sectional correlation
Correlation: common AR(1) coefficient for all panels (0.8682)
Estimated covariances = 496 Number of obs = 310
Estimated autocorrelations = 1 Number of groups = 31
Estimated coefficients = 9 Time periods = 10
wald chi2(8) = 1118.61
Prob > chi2 = 0.0000
```

lnrs	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
lnuer	-.0589878	.0133607	-4.42	0.000	-.0851743	-.0328013
lnRoadDes	.127461	.0260049	4.90	0.000	.0764924	.1784297
lnagg	.2146984	.0316181	6.79	0.000	.152728	.2766687
lnincome D1.	1.046728	.1745957	6.00	0.000	.7045267	1.388929
lnftv	.0380771	.0067832	5.61	0.000	.0247823	.0513719
lnincome_iu	.019393	.0035479	5.47	0.000	.0124393	.0263467
central	-.2425083	.025625	-9.46	0.000	-.2927324	-.1922842
west	-.3245224	.0384797	-8.43	0.000	-.3999412	-.2491036
_cons	-1.513756	.180432	-8.39	0.000	-1.867396	-1.160116

Table S6-1. Robustness test of all policy and market factors(1)

```
. ivregress gmm lnrs lnuer lnRoadDes (lnagg=L.lnagg) D(lnincome) lnftv lnui central west, vce(r)
```

Instrumental variables (GMM) regression

GMM weight matrix: Robust

Number of obs = 310
wald chi2(8) = 520.95
Prob > chi2 = 0.0000
R-squared = 0.6766
Root MSE = .25444

lnrs	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
lnagg	.2777449	.0995692	2.79	0.005	.0825929	.4728968
lnuer	-.1939795	.0407301	-4.76	0.000	-.273809	-.11415
lnRoadDes	.1261744	.0222197	5.68	0.000	.0826246	.1697242
lnincome D1.	2.170317	.9512421	2.28	0.023	.3059163	4.034717
lnftv	.0586644	.0305578	1.92	0.055	-.0012278	.1185565
lnui	.23495	.0803198	2.93	0.003	.0775261	.392374
central	-.1796144	.0488804	-3.67	0.000	-.2754183	-.0838105
west	-.2597907	.053148	-4.89	0.000	-.3639589	-.1556225
_cons	-1.86425	.4006198	-4.65	0.000	-2.649451	-1.07905

Instrumented: lnagg

Instruments: lnuer lnRoadDes D.lnincome lnftv lnui central west L.lnagg

Table S6-2. Robustness test of all policy and market factors(2)

```
. ivregress gmm lnrs lnuer lnRoadDes (lnagg=L.lnagg) D(lnincome) lnftv lnincome_iu central west, vce(r)
```

Instrumental variables (GMM) regression

GMM weight matrix: Robust

Number of obs = 310
wald chi2(8) = 604.49
Prob > chi2 = 0.0000
R-squared = 0.7050
Root MSE = .243

lnrs	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
lnagg	.1106187	.0982857	1.13	0.260	-.0820178	.3032551
lnuer	-.1792883	.038505	-4.66	0.000	-.2547568	-.1038199
lnRoadDes	.119007	.0223524	5.32	0.000	.0751972	.1628168
lnincome D1.	2.420452	.9260674	2.61	0.009	.6053931	4.235511
lnftv	.0403463	.028933	1.39	0.163	-.0163615	.097054
lnincome_iu	.0378022	.0070786	5.34	0.000	.0239284	.051676
central	-.1335157	.0489036	-2.73	0.006	-.229365	-.0376664
west	-.2122371	.0525411	-4.04	0.000	-.3152158	-.1092585
_cons	-1.427692	.4017754	-3.55	0.000	-2.215157	-.6402263

Instrumented: lnagg

Instruments: lnuer lnRoadDes D.lnincome lnftv lnincome_iu central west L.lnagg

Table S7-1. Robustness test of Spillover effects(1)

```
. ivregress gmm lnrs lnuer lnRoadDes (lnagg=L.lnagg) D(lnincome) lnftv lnedu_agg central west, vce(r)
```

Instrumental variables (GMM) regression

GMM weight matrix: Robust

Number of obs = 310
wald chi2(8) = 527.37
Prob > chi2 = 0.0000
R-squared = 0.6837
Root MSE = .25165

lnrs	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
lnagg	.2104539	.1119847	1.88	0.060	-.0090322	.42994
lnuer	-.180954	.0342693	-5.28	0.000	-.2481206	-.1137874
lnRoadDes	.0924732	.026079	3.55	0.000	.0413593	.1435871
lnincome D1.	3.031811	1.04402	2.90	0.004	.9855693	5.078052
lnftv	.0412623	.0271472	1.52	0.129	-.0119453	.09447
lnedu_agg	.1265581	.0394302	3.21	0.001	.0492764	.2038398
central	-.2000231	.0456447	-4.38	0.000	-.289485	-.1105612
west	-.2558595	.0533864	-4.79	0.000	-.3604949	-.1512241
_cons	-2.239971	.3628418	-6.17	0.000	-2.951128	-1.528815

Instrumented: lnagg

Instruments: lnuer lnRoadDes D.lnincome lnftv lnedu_agg central west L.lnagg

Table S7-2. Robustness test of Spillover effects(2)

```
. ivregress gmm lnrs lnuer lnRoadDes (lnagg=L.lnagg) D(lnincome) lnftv lnincome_edu central west, vce(r)
```

Instrumental variables (GMM) regression

Number of obs = 310
 Wald chi2(8) = 685.46
 Prob > chi2 = 0.0000
 R-squared = 0.7241
 Root MSE = .23503

GMM weight matrix: Robust

	lnrs	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]
lnagg		.400834	.0589633	6.80	0.000	.2852681 .5163999
lnuer		-.1538601	.0307987	-5.00	0.000	-.2142245 -.0934958
lnRoadDes		.0753639	.0254303	2.96	0.003	.0255215 .1252063
lnincome D1.		3.40315	1.048148	3.25	0.001	1.348818 5.457481
lnftv		.0155415	.0221072	0.70	0.482	-.0277878 .0588707
lnincome_edu		.0864582	.015567	5.55	0.000	.0559475 .1169689
central		-.1524057	.0455849	-3.34	0.001	-.2417504 -.063061
west		-.1929489	.0549351	-3.51	0.000	-.3006197 -.0852781
_cons		-3.684119	.4421755	-8.33	0.000	-4.550767 -2.817471

Instrumented: lnagg
 Instruments: lnuer lnRoadDes D.lnincome lnftv lnincome_edu central west
 L.lnagg

Table S7-3. Robustness test of Spillover effects(3)

```
. ivregress gmm lnrs lnuer lnRoadDes (lnagg=L.lnagg) D(lnincome) lnftv lnincome_edu central west, vce(r)
```

Instrumental variables (GMM) regression

Number of obs = 310
 Wald chi2(8) = 515.75
 Prob > chi2 = 0.0000
 R-squared = 0.6896
 Root MSE = .24926

GMM weight matrix: Robust

	lnrs	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]
lnagg		.2550133	.0876506	2.91	0.004	.0832212 .4268054
lnuer		-.1853639	.0375499	-4.94	0.000	-.2589603 -.1117674
lnRoadDes		.1084704	.0241712	4.49	0.000	.0610957 .1558451
lnincome D1.		2.789045	.9825392	2.84	0.005	.8633035 4.714786
lnftv		.0427721	.0292559	1.46	0.144	-.0145683 .1001126
lnincome_edu		.1204859	.0310102	3.89	0.000	.059707 .1812648
central		-.1709922	.0478485	-3.57	0.000	-.2647735 -.0772109
west		-.2414374	.0526766	-4.58	0.000	-.3446816 -.1381932
_cons		-1.829913	.3820163	-4.79	0.000	-2.578652 -1.081175

Instrumented: lnagg
 Instruments: lnuer lnRoadDes D.lnincome lnftv lnincome_edu central west
 L.lnagg