Province-Level Determinants of China's Food Processing Establishment Growth: 2000-2009

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Abstract Since the 21st century, China's food processing industry has been growing drastically, and its spatial striucture has been changing considerably. The characteristics of the location, movement of China's food processing sector are summarized in this paper. Empirical models are developed and estimated to identify the economic determinants of China's food processing establishment growth between 2000 and 2009. It is found that raw materials, market access and transport are the key factors determining spatial structure of China's food processing industry between 1995 and 2009. The ability of to attract food processor to create local employment opportunities and market outlet for farmers vary Chin's food processing industry considerably across provinces.
Key words Food industry; Food processing industry; Establishment growth; Spatial sturcture

1 Introduction

China is one of the largest producers, consumers and importers of agricultural products and processed food in the world. Since the 21st century, China's food processing industry had been developing rapidly; the sales value and pre-tax profits of food processing sector grow 194% and 184% respectively. Meanwhile, the regional growth of food processing sector varies considerably across provinces in China. Some province's shares of output value in total industry decrease, which produce a large number of processed food traditionally. Some province's shares of output value in total industry increase, which don't produce a great quantity of processed food. With the serious surplus of production capacity in total industry, lots of food processing factories are established in main agricultural production regions and coastal regions. At present, promotion of value-added activities in food processing sector is increasingly viewed by central government and local governments as an economic development strategy designed to create local employment opportunities and market outlet for farmers. The above questions should be paid more attention [1].

In order to explain above questions, this paper briefly summaries relevant literatures, next systematically analyses the spatial structural changes in China's food processing sector since the 21st century, thirdly, examining province-level determinants of food processing establishment growth by model and data, finally, discloses the conclusion and its implications for policy maker.

2 Literature Review

An extensive location literature can be used to guide the specification of growth model for food processing establishments.

(Catherine A. Durham, Richard J. Sexton, and Joo Ho Song 1996) examines the role of spatial pricing in the allocation of processing tomatoes from farms to the thirty-two processing facilities located in northern and central California. A nonlinear mathematical programming model is developed to determine the optimal allocation of processing tomatoes. The analysis reveals foregone profits of 1.9% from inefficient product allocation. Simulation results reveal significant competition among processors despite their separation in many cases by long distances [2].

(Stephan J. Goetz 1997) identified economic determinants of food manufacturing establishment growth between 1987 and 1993 by empirical models. Significant agglomeration diseconomies are found to exist for nearly all sub-industries at the county level, but not at the state level. The ability of rural counties to attract food processors to create local employment opportunities and market outlets for farmers varies considerably across sub-industries [3].

(Hayri Onal, Laurian Unnevehr, and Aleksandar Bekric 2000) discussed the regional shifts in U.S. pork production, and its implications for competition and food safety. A regional model of farm supply and processing demand shows that smaller Midwest operations can survive only if processing capacity remains concentrated in that region [4].

(Edamwen M. Omoregie and Kenneth J. Thomson 2001) use a spatial equilibrium model of the Nigeria's oilseeds economy is to determine the optimal location and number of mills across regions, and to establish regional competitiveness in aid of the planning and development of the oilseeds sub-sector. The shadow prices of the arable land and milling capacities are used as a measure of competitiveness [5].

However, the existing literature doesn't so far focus its attention on developing China. This paper attempts to enrich the existing literature by examining province-level determinants of food processing establishment growth. This paper will develop a regional location model incorporating major elements of industrial location theory, in order to provide a useful methodological tool for investigating industry location potential at the province level.

3 Overview of Regional Growth in China's Food Processing Industry

3.1 The changing regional distribution of grain production in China

Since the late 1990s, the regional distribution of grain production in China had been changing considerably. The main grain-producing areas have shifted from the south to the north of China. At present, the grain output of three main production regions including Northeast region, Huang-Huai-Hai plain and Middle-lower Yangtze Plain, accounts 74.9% of total grain output in China (See table 1). In 2008, the wheat production quantity of Henan province is 30,510,000 metric tons, ranks first in China. The wheat production quantity of Shandong province is 20,342,000 metric tons, ranks second in China. The sum of Henan's and Shandong's wheat output accounts 45.2% of total wheat output. The rice production quantity of Hunan province is 25,280,000 metric tons, ranks first in China. The rice production quantity of Jiangxi province is 18,621,000 metric tons, ranks second in China. The sum of Henan's and Shandong's rice output accounts 22.9% of China's rice output. The maize production quantity of Jilin province is 20,830,000 metric tons, ranks first in China. The maize production quantity of Shandong province is 18,874,000 metric tons, ranks second in China. The sum of Jilin's and Shandong's maize output accounts 23.9% of China's maize output.

Table 1 Output of Three Main Grain Production Regions in 2008 (Thousand Metric Tons)

	Output	Share
China	528,709	
Northeast region	103,098	19.5%
Huang-Huai-Hai plain	158,084	29.9%
Middle-lower Yangtze Plain	134,821	25.5%
Total	396,003	74.9%

Source: Calculated from China Statistical Yearbook.
Note: "Northeast region" includes Heilongjiang, Jilin, Liaoning and the east regions of Neimenggu.

3.2 Changes in spatial agglomeration of China's food processing sector

Three measures are used to reflect the spatial agglomeration of China's food processing sector since 21st century: share of total output value of top 4 provinces in total industry (C4), share of total output value of top 8 provinces in total industry (C8), and Herfindahl-Hirschman Index (HHI) (See table 2). Between 2000 and 2009, C4, C8 and HHI increase to 59.0%, 77.8%, and 997, from 47.0%, 71.0% and 900 respectively. In the whole, the spatial agglomeration of China's oilseeds processing sector has been increased.

Table 2 Spatial Agglomeration of China's Food Processing Sector

	C4 (%)	C8 (%)	HHI
2000 Data	47.0	71.0	900
2003 Data	54.4	74.3	980
2006 Data	57.4	76.3	988
2009 Data	59.0	77.8	997

Source: Calculated from China Yearbook of Market Survey, China Yearbook of Food Industry Survey and China Food Industry Association.

3.3 Growth of food processing sector in main agricultural production regions and coastal regions

In recent years, more and more food processing establishments had been entering into main agricultural production regions. Traditional agricultural region's food processing industry developed rapidly, while coastal region's food processing industry increased gradually.

As traditional agricultural province, Henan's and Anhui's shares of processed food output value in total industry increases continuously. As developed coastal province, Shandong's and Guangdong's shares of processed food output value in total industry don't increase rapidly, while Jiangsu's share decreases in some extent (See table 3).

At present, the top 4 provinces in China's food processing industry are Henan, Shandong, Anhui and Guangdong, represents 59% of total industry's output value.

Table 3 Regional Growth of China's Food Processing Sector

	2000 Data	2003 Data	2006 Data	2009 Data
Top 4 provinces[1]	Shandong	Shandong	Shandong	Henan
	Guangdong	Guangdong	Henan	Shandong
	Jiangsu	Henan	Guangdong	Anhui
	Anhui	Jiangsu	Anhui	Guangdong
Share[2]	47.0%	54.4%	57.4%	59.0%

Source: Calculated from China Yearbook of Market Survey, China Yearbook of Food Industry Survey and China Food Industry Association.

Note: (1) "Top 4 provinces" is those provinces, whose share of output value in total industry is top 4.

(2) "Share" is the share of total output value of top 4 provinces in total industry.

4 The Model to Identify Province-level Determinants of Food Processing Establishment Growth

4.1 Estimation procedure and data

Alfred Weber developed his minimum transport cost theory in 1909. He based his location theory on minimum transport cost but expanded Launhardt's approach by introducing variables (labor cost, agglomerating factors and deglomerating factors) in an economic closed system and applied it to a (variety of industries. August Losch 1940) introduced many other elements into his formula, including economic, human, natural and political factors. Prices are considered in the context of areas subject to monopolistic competition, and pricing mechanisms are discussed. Losch concluded that demand is more elastic in an industrial economy than in an agricultural economy, and supply is more elastic in an agricultural economy [6].

Based on the above theories, this paper develops a location model to identify the economic determinants of regional growth of China's food processing industry between 2000 and 2009, and estimate how numerous province-level factors, including transport cost, labor cost, spatial agglomeration and local demand, affect the location, movement, and intensity of food processing establishments within 31 provinces.

The province-level regression is $RG_i = f(AP_i, MP_i, RW_i, SA_i, D_i, U_i)$, where $i = 1, 2, \ldots, 31$ provinces, U_i is the error term.

Dependent variable RG_i, which is net change of the share of each province's output value in total industry between 2000 and 2009, i.e. $RG_i = RG_{i2009}$-, $RG_{i2000,}$ reflects the spatial structural changes of food processing sector.

Independent variables included in the regression are raw materials production, access to output markets, labor cost, agglomeration economies and dummy variable. Province-level variables used determining food processing establishment growth are discussed in turn.

(1) Raw materials production (AP_i). Raw materials production (AP_i) is reflected by total production quantities of wheat, rice and maize within each province. A higher value of AP_i implies food processing sector in a province can be served by taking advantage of lower transportation charges by locating in that province. The expected sign of AP_i is positive.

(2) Access to output markets (MP_i). This "market potential" measure (MP_i) captures effective demand to processed food within each province, which is reflected by population quantities within each province. A higher value of MP_i implies food processing sector in a province faces a larger potential market. The expected sign of MPi is positive.

(3) Labor cost (RW_i). Labor cost (RW_i) is reflected by province-wide wages per capita in food processing sector. Higher wages are associated with higher labor costs. A higher value of RW_i implies food processing sector in a province has disadvantage of cost. The expected sign of RW_i is negative.

(4) Agglomeration economies (SA_i). Agglomeration economies (SA_i), which captures the structural effects of agglomeration economies specific to each province, is reflected by the output value of food processing sector within each province in 1995. The sign of SA_i may be positive or negative.

(5) Dummy variable (D_i). Dummy variable (D_i), which captures the effects of transportation condition specific to each province, is reflected by seaports with. For a province, within which there is

seaports, $D_i = 1$. For a province, within which there is not a seaport, $D_i = 0$. The expected sign of D_i is positive.

4.2 Regression result

OLS parameter estimates for province-level establishment growth equation are reported in the following.

$$RGi = -2.58342 + 0.01578APi + 0.00159MPi + 0.00158RWi - 0.03431SAi + 3.27437Di$$

(1.01) (-1.19) (2.22) (-1.72) (2.33) (2.14)

The equation yields a R^2 value ($R^2 = 0.48$). AP_i (Raw materials production), MP_i (Access to output markets) and D_i (Dummy variable) have a statistically significant, positive effect on food processing establishment growth.

5 Conclusion

In this paper, the determinants of establishment growth in China's food processing industry are identified. Raw materials production, market accession and seaport are the key factors determining spatial structure of China's food processing sector between 2000 and 2009. It implies that modern food processing establishments pay more attention to agricultural production regions, besides demand market. Consequently, the ability of traditional agricultural production provinces to attract food processors to stimulate local employment and provide nearby market outlets for farmer increases. These results suggest that governments should encourage main grain production regions to be world agglomeration regions of food processing and export centre in the long term.

In the other hand, lower labor cost doesn't attract food processors. It implies that traditional agricultural regions and developing regions should pay more attention to improving efficient of agricultural production, agricultural product logistics, and human capital.

This study also confirms the complexity and difficulty of modeling food processing establishment growth or location decisions. It is difficult to make generalizations about variables which are consistently significant across each of individual sub-industries. Future research using primary survey data from individual firms may reveal other possible methods of modeling establishment growth and underlying location decision.

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Study on Optimization of Earthquake Transportation Emergency Management System

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Abstract Earthquake transportation emergency management is to study the traffic management of disaster area after the earthquake. Based on the assessment of traffic response demand forecasting and emergency response capability, this paper develops the relevant traffic contingency plans, and implements traffic emergency decision-making, organization and management measures in emergency rescue. All of these can minimize human injury, property damage and consumption of resources. Optimized earthquake transportation emergency management system can be divided into traffic emergency decision-making command system, traffic emergency demand forecasting system, traffic emergency passing capability assessment system, system of traffic emergency plan's integrating and implementing, traffic emergency support system, traffic emergency capacity enhance system. This paper describes the process of traffic emergency model.
Key words Earthquake rescue; Traffic system; Emergency management; Management system

1 Introduction

China is one of countries suffering earthquake disasters seriously, and its destructive earthquakes occurred in the 20th century accounted for one-third of worldwide, the death accounted for 50%, up to 60 million people[1]. The early 21st century, in less than two years time, Wenham earthquake and the earthquake in Yushu happened, causing tremendous casualties and property losses in China. The two earthquakes both occurred in the mountains, so the traffic is the common difficulty faced in the rescue. Rescue after the earthquake is an extremely complex system. The research on how to clear the traffic in the shortest time, choose the reasonable transportation route and means, deliver the earthquake casualties and transport relief supplies, and enhance the built of post-earthquake emergency management system of traffic, has important theoretical and practical significance.

Some experts and scholars in China and abroad have done research on traffic management after the different earthquakes. Chiang and Jin stetted up network chart of earthquake versus water supply system, transportation system, power supply system, communication system, medical ensuring system, which demonstrated that transportation system is playing the very vital role[2]. Chang and Nojima brought forward Ds indicators to assess the Overall function of post-disaster traffic system for Kobe earthquake[3]. Wang Zhitao and others established decision-making information system with function of transportation system management, path analysis and searching, by ArcGIS Engine' network analysis Interface Technology according to post-earthquake relief[4]. Liu Chunguang and others conducted reliability analysis to urban transport network, and provided decision for the best location of Post-earthquake rescue team and Road Section need to be strengthen and reconstruct[5]. Earthquake transportation emergency management research focused on the assessment of traffic situation in urban post-earthquake, statistics analysis and evaluation on traffic damage in non-urban areas and remote mountain areas is very few. While there isn't any systematic research on traffic emergency management of suburb areas after earthquake blank currently.

2 Contents of Earthquake Transportation Emergency Management System

It is not a long time to research on traffic emergence management in China. Although we have achieved a certain success, the comprehensive capacity of traffic emergence management is weak, particularly in the treatment of traffic emergence in the earthquake relief work. It exposes many questions, such as insufficient preparation, slow response, and improper treatment and ill balanced. It is concretely represented in the following aspects:

(1) Imperfection of transportation emergency decision-making guiding system, and also lack of unified traffic emergency command organization after the earthquake.

(2) The transportation emergency demand forecasting is not very prompt and accurately, also the method isn't scientific.

(3) The transportation emergency capability appraisal way is not perfect; and the result is not very