Study on food quality and safety management model based on industrial agglomeration theory

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\begin{abstract}
As a representative industry of agricultural product quality and safety, food is an important cornerstone of stable social development and international status. However, frequent food quality and safety incidents reveal the complexity and difficulty of governance. Therefore, it is urgent to treat and solve food quality and safety problems through comprehensive, multi-level and multi-perspective research. Through the research on the current situation of food quality and safety in China, this paper puts forward the perspective of food quality and safety management based on the theory of industrial agglomeration, clarifies the technical route of this paper, constructs two theoretical models of enterprise and government, and expounds the internal mechanism of the model. Finally, according to the conclusion of the theoretical model, the realization path of food quality and safety management based on industrial agglomeration theory is proposed.
\end{abstract}

Introduction

With the improvement of the level of economic development and the quality of life, the Chinese people’s attention to food issues has reached an unprecedented level. Food quality and safety has become one of the top ten focus issues in the process of China’s overall well-off society from 2009 to 2019, and has been ranked first in 2012–2017. Food quality and safety is not only related to the safety of people’s lives, but also an important cornerstone of stable social development and international status, which has attracted the attention of political, academic, public and media. Therefore, ensuring food quality and safety has become an important problem to be solved in the development of China’s food industry, which is of great significance to China’s social stability and economic development. Preference for much more variety and healthy food is booming as incomes rise and lifestyles change. Farmers profit locally and internationally when economies improve and supply for agricultural products rises.

As a matter of fact, food safety issues have aroused extensive concern and full attention from all walks of life. While there are numerous food safety risks that really can lead to food contaminants, the majority of them fall under three subgroups: microbiological, physiological, or chemical. When a physical item reaches food during the preparation stage, it is referred to as physical contamination. When foodstuff came in contact with or creates hazardous chemicals, it can result in chemical contaminated food. Biological contamination happens whenever organic creatures or the compounds they create infected food (Saravanan et al. 2015). A series of studies have been carried out from academia to the industry, and a number of solutions have been put forward for food quality and safety management. The enhancements can be designed on finding possible food contamination as well as crucial control points where the systems have the capacity to inhibit, reduce, or eradicate a possible issue. It’s essential to confirm that food stays within target limitations at each important control point with the correct sensors. To reduce risk, your strategy should include the equipment you’ll need to have in your facility, and how it’s built and operated. Food quality and safety has been attached great importance by the state. During 2008–2015, the food safety law of the people’s Republic of China has been revised many times, which represents not only the change of legislative form and content, but also the change of legislative concept and thought. Over the years, a lot of funds and manpower have been invested in the special rectification work of food safety from the central government to local regulatory departments.
Through the organization of large-scale sampling action to supervise and inspect the food quality and safety problems, although the overall situation of food quality and safety is getting better, the food safety problems have not been fundamentally solved, which fully reflects the complexity and difficult governance of food quality and safety problems. It is urgent to treat and solve the food quality and safety problems through comprehensive, multi-level and multi perspective research.

As a localized production mode, industrial agglomeration not only has the characteristics of concentration, regionality and controllability, but also can promote the full and reasonable allocation and effective utilization of factor resources. It has become a strategic mode for various countries to achieve quality control. China has also issued a number of policies to actively guide the food industry to gather in industrial zones and belts. In 2017, the No. 1 central document explicitly emphasized the ‘guiding processing enterprises to concentrate on the main producing areas, the dominant producing areas and the industrial parks, and to create the food processing industry gathering zone in the advantageous agricultural areas’. In 2018, the State Council General Office issued the ‘opinions on promoting the dairy industry to ensure the quality and safety of dairy products’, which ‘supports the development of milk for enterprises’. To promote the cluster development of dairy industry, promote the optimization and upgrading of the industry, improve the quality and efficiency of the dairy supply system, and enhance the quality and safety assurance level of the industry. After joining the dairy cluster, the fields will progressively enhance their operational and economic efficiency by improving feed, administration, reproduction, and animal care. These benefits are projected to be the consequence of investment in new technology, as well as in consultancy services, feed providers, milk producers, and other clusters participants’ talents, expertise, goods, and assistance. Dairy chains connect the individuals and actions associated with getting milk and milk products to the end customer whereas the item’s value rises for each operation. Producing, transportation, refining, packing, and warehousing can all be part of a dairy chain (Gao et al. 2020). A dairy company can overcome challenges by improving business processes and implementing innovative low-cost solutions. Dairy businesses can now make better day-to-day selections to manage milk quality, productivity, and supply chain which are to advances in technology and increasing access to information (Subramaniaswamy et al. 2018). The research of some scholars shows that industrial agglomeration has a positive and significant impact on improving the quality of export products (Liu et al. 2016; Su et al. 2018; Tian and Tang 2018). Then, will industrial agglomeration also have an impact on China’s food quality and safety? There are many factors affecting food quality and safety. If we study the essence of food quality and safety, we can find that on the one hand, food quality and safety is produced by enterprises; on the other hand, it is supervised by the government. Then, will industrial agglomeration affect food quality and safety through enterprises and government? Its internal theoretical logic, mechanism and realization path are worthy of systematic and comprehensive analysis, which is also the scientific problem that this paper tries to solve.

This work takes a theoretical background on the food enterprises towards safety and productivity. Several factors are analyzed towards the economic development of the food safety and food quality based on industrial agglomeration theory.

**Theoretical model of food quality and safety management from the perspective of industrial agglomeration**

Food safety is linked to people’s quality of life as well as business, with customers’ desire for high-quality food protection increasing year after year. It is vital to improve food standards and maintain food security. The drivers of food business quality of product and the process by which economic aggregation influences quality of food as just an intermediate factor is explored, providing a theoretical basis again for empirical study.

**Enterprise level: theoretical model of the impact of industrial agglomeration on food quality and safety**

Based on the theoretical framework of Melitz Marc (2003) and Crozet and Koenig (2005), this paper constructs a theoretical model of the impact of industrial agglomeration on food quality and safety. The quality of products of Chinese food businesses is greatly improved by economic clustering. Overall, the economic effect of the homogeneity analyses showed that industrial agglomeration is much more essential to promote the customer satisfaction of non-state-owned businesses and food businesses. Through the interconnected supply chain, it may enhance the circulation and exchange of components among firms while also lowering transaction fees.

**Consumer behavior**

The production area of the product is expressed as $B$, and the sales area is expressed as $E$, where $B, E \in \mathbb{R}, N$. The Competency Enhancement solution (CES)
provides food security and assurance support services to food service producers, retail, cafes, and catering services through on-site consulting, audits, and guiding. Assuming that the consumer utility function is in the form of CES, the product quality and safety is embedded into the consumer utility function:

$$U = \left\{ g \in \Omega \left( \lambda |q(g)|^{\sigma - 1} \right) \right\}^{\sigma/(\sigma - 1)}$$  \hspace{1cm} (1)

Where $g$ is the final product; $\Omega$ is the collection of products from $B$ and $E$; $\lambda$ is the quality and safety level of product $g$; $q(g)$ is the consumer demand of product $g$; $\sigma(\sigma > 1)$ is the substitution elasticity between different types of products. Under the given budget constraints, according to the consumer utility maximization equation, the optimal solution is obtained, and the total consumer demand for product $g$ is as follows:

$$q(g) = \lambda g^{\sigma - 1} p(g)^{-\sigma} p^\sigma - Y \sigma > 1$$  \hspace{1cm} (2)

Where, $p(g)$ is the price of $g$ products in $E$ region; $P$ is the price index of $E$ region; $Y$ is the total income of $E$ region.

**Producer behavior**

It is assumed that enterprises in region $B$ are free to enter or exit the food industry, and the market structure is monopolistic competition. When there are several enterprises in a market providing similar products but not equivalent, monopolistic competition arises. These businesses, unlike monopolies, have minimal capacity to restrict supply or increase rates to maximize profits (Balamurugan et al. 2020). The productivity level of food enterprise $i$ is $\varphi_i$. Each food enterprise uses labor factors to produce differentiated products with increasing returns to scale. This chapter is based on $\mu_i$ is the degree of food industry agglomeration in the region where food enterprises are located. Industrial agglomeration mainly reduces the production cost of food enterprises through external economies of scale. Industrial agglomeration areas have labor sharing market, broad intermediate goods supply market and specialized division and cooperation network, which can reduce the production cost and transaction cost of enterprises. Food and beverage producers who encourage external collaboration alongside its ingredient supply chain members might achieve another more substantial competitive edge. In this chapter, the cost function of food enterprise $i$ in region $E$ is set as follows:

$$C_i = \frac{wx_i}{\varphi_i \mu_i} + \alpha$$  \hspace{1cm} (3)

Where $w$ is the wage level in $E$ area; $x_i$ is the output of food enterprise $i$; $\alpha$ is the fixed cost of food enterprise.

In the $E$ region, affected by consumers’ diversified consumption demand preference, and each food enterprise has increasing returns to scale and produces differentiated products, it will not choose to produce the same product with other enterprises, that is, each food enterprise will choose one product to produce. Given the price index of region $E$, if the food enterprises in region $B$ set their own product prices, the price elasticity of demand faced by the food enterprises in region $B$ is equal to the constant substitution elasticity of different products in region $E$. Many factors influence the price elasticity of demand. The accessibility of commodities, market prices, levels of income, time frame, and type of products are five critical criteria. Based on the above analysis, the optimal decision of food enterprise $i$ in region $B$ to sell its products to region $E$ is as follows:

$$\max \pi_i = \left( p_i - \frac{w \tau}{\varphi_i \mu_i} \right) \lambda^{\sigma - 1} p^{-\sigma} Y \sigma - \alpha$$  \hspace{1cm} (4)

Where $\tau$ is the iceberg cost. According to the above formula, following the principle of enterprise profit maximization, the optimal output and pricing of product $g$ of food enterprise $i$ in region $B$ are as follows:

$$x_i = \frac{\lambda^{\sigma - 1} p^{-\sigma - 1} Y}{\varphi_i^{\frac{\sigma}{\sigma - 1}}} \left( \frac{w \tau}{\varphi_i^{\frac{\sigma}{\sigma - 1}}} \right)^{-\sigma}$$  \hspace{1cm} (5)

$$p_i = \frac{w \tau}{\varphi_i^{\frac{\sigma}{\sigma - 1}}} \left( \frac{\sigma}{\alpha - 1} \right)$$  \hspace{1cm} (6)

If it is brought into (4), the maximum profit of the enterprise can be obtained as follows:

$$\pi_i = \frac{1}{\sigma - 1} \alpha \frac{\varphi_i^{\frac{\sigma}{\sigma - 1}} - \frac{\sigma}{\alpha - 1}}{w \tau} \lambda^{\sigma - 1} p^{-\sigma - 1} Y \sigma - \alpha$$  \hspace{1cm} (7)

When the market structure is monopolistic competition market, the enterprise can freely enter and leave the food industry, and can know that the food enterprise reaches equilibrium when the profit is zero. At this time, the equilibrium output of product $g$ produced by food enterprise $i$ in region $B$ can be obtained as follows:

$$x_i = \frac{\alpha \varphi_i^{\frac{\sigma}{\sigma - 1}} (\sigma - 1)}{w \tau}$$  \hspace{1cm} (8)

**Equilibrium**

The demand function in (1) and the cost function in (2) are combined to discuss the model equilibrium. The system evaluates the equilibrium of the food business and achieves food amount and quality balance by building an equilibrium model. It looks at how competition affects prices, productivity, profitability, and societal welfare. It could indicate that society benefits from commitment to quality while manufacturers lose money.
Furthermore, as a result of the restriction, social welfare initially rises and then falls. This chapter assumes that all the products produced by food enterprises in region B will be exported to region E, then in the market equilibrium, the output of product g produced by food enterprises in region B is equal to the consumer demand for product g in region E, that is, \( x_g = q(g) \), then:

\[
\frac{\alpha \varphi \mu_i (\sigma - 1)}{w_f} = \lambda_i^{\sigma - 1} p_i^{\sigma - 1} \gamma
\]

After sorting, we can get the optimal quality level when the enterprise pursues profit maximization \( \lambda_i \) is:

\[
\lambda_i = \frac{1}{\rho \sigma - 1} \frac{\sigma - 1}{Y \sigma - 1} \frac{1}{w_f \sigma - 1} \frac{1}{\mu_i \sigma - 1}
\]

By seeking partial derivative of \( \mu_i \), which represents the level of food industry agglomeration, we can get the following conclusions:

\[
\frac{\partial \lambda_i}{\partial \mu_i} = \frac{p_i}{p} \left[ \frac{\sigma (\sigma - 1)}{Y \sigma - 1} \frac{1}{\mu_i \sigma - 1} \right] \left[ \frac{\varphi_i^{\sigma - 1}}{\mu_i^{\sigma - 1}} + \frac{1}{\varphi_i^{\sigma - 1}} \left( \frac{1}{\mu_i^{\sigma - 1}} \right) \right]
\]

Government level: theoretical model of the impact of industrial agglomeration on food quality and safety

As the two main bodies affecting food quality and safety, the government’s food quality and safety supervision behavior and the enterprise’s production behavior work together, which will directly affect the level of food quality and safety.

**Assumption 1:** both government regulators and enterprises are completely rational, understand each other’s strategies, and choose their own strategies according to the basic principles of cost minimization and benefit maximization.

**Assumption 2:** in order to maintain market order and ensure food quality and safety, government regulatory departments will supervise and manage food quality and safety according to laws and regulations. Therefore, the government’s regulatory strategy set is \( S = (S_1, S_2) = (\text{to supervise the food quality and safety of enterprises, not to supervise the food quality and safety of enterprises}) \). However, considering the cost and implementation difficulty in the actual supervision process, the government will carry out food safety supervision and spot check on enterprises. The spot check frequency is \( N_0 \), and the production situation of enterprises is reviewed. At this time, the supervision cost invested by the government for the supervision enterprises is \( C_p \), and the income obtained by the government for the supervision enterprises in the production of quality and safety food is \( B_p \).

**Assumption 3:** in order to maximize their own interests, enterprises will sell quality safety food or non-quality safety food in the market. The strategy set of enterprises is \( E = (E_1, E_2) = (\text{produce quality safety food, produce non-quality safety food}) \). The selling price of quality safety food is \( P_e \) and the cost is \( C_i \). The cost of producing inferior non quality safety food is \( C_2 \), and \( C_1 > C_2 \). When an enterprise produces non quality and safety food, if it is found and punished by the government in the process of supervision, the enterprise will pay the penalty price of \( F_e \). If the government does not find it, it will not be punished, and the enterprise does not need to spend any money.

**Assumption 4:** if the government does not supervise the production of non-quality and safety food, the production of non-quality and safety food will have a very bad social impact, and the loss to the government is \( L_r \). If the government supervises the production of non quality and safety food, and carries out corresponding punishment to severely crack down on the production and sales of low-quality
food, the regulatory income generated by the government is \( F_e - C_g \).

Based on the above assumptions, this paper sets the relevant parameters according to the costs, benefits and penalties involved in the process of food production and supervision by enterprises and the government, and its meaning is shown in Table 1.

At the same time, in the actual business process, enterprises do not know the probability of government supervision. Suppose that the probability of government supervision is \( \alpha (0 \leq \alpha \leq 1) \), and its mixed strategy is \( \delta_1 = (\alpha, 1-\alpha) \); the probability of producing quality and safety food is \( \beta (0 \leq \beta \leq 1) \), and its mixed strategy is \( \delta_2 = (\beta, 1-\beta) \). According to the above assumptions, this paper constructs the income matrix of the mixed strategy game between the government regulatory authorities and enterprises, as shown in Table 2.

1. To prevent becoming predicted, a mixed approach is a distribution function that is used to choose between maximum possible at randomly. In a mixed strategy equilibrium, each participant in a competition employs a combination approach, ones that is most advantageous to him in comparison to the strategies employed by other participants. By constructing a mixed strategy game model between government regulators and enterprises, it can be seen that when the probability \( \beta \) of producing quality and safety food remains unchanged, the revenue functions of government regulators and non regulators are \( R_g \) and \( R_{g2} \), respectively:

\[
R_g = \alpha \beta (B_y - C_y) + \alpha (1-\beta)(F_e - C_g)
\]

\[
R_{g2} = (1-\alpha)\beta B_y + (1-\alpha)(1-\beta)(-L_1)
\]

The total revenue function of government supervision department is \( R_g = R_{g1} + R_{g2} \), which can be expressed as:

\[
R_g = \alpha \beta (B_y - C_y) + \alpha (1-\beta)(F_e - C_g) + (1-\alpha)\beta B_y + (1-\alpha)(1-\beta)(-L_1)
\]

1. When the probability \( \alpha \) of government supervision is constant, the income of enterprises producing quality safety food and non quality safety food is \( R_{e1} \) and \( R_{e2} \), respectively:

\[
R_{e1} = \beta \alpha (P_e - C_1) + \beta (1-\alpha)(P_e - C_1)
\]

\[
R_{e2} = (1-\beta)\alpha (P_e - C_2 - F_e) + (1-\beta)(1-\alpha)(P_e - C_2)
\]

The total income function is \( R_e = R_{e1} + R_{e2} \), which can be expressed as:

\[
R_e = \beta \alpha (P_e - C_1) + \beta (1-\alpha)(P_e - C_1) + (1-\beta)\alpha (P_e - C_2 - F_e) + (1-\beta)(1-\alpha)(P_e - C_2)
\]

The derivation of the total revenue \( R_g \) of the government supervision department and the total revenue \( R_e \) of the enterprise are as follows:

\[
\frac{\partial R_g}{\partial \alpha} = \beta (B_y - C_y) + (1-\beta)(F_e - C_g) - \beta B_y - (1-\beta)(-L_1) = 0
\]

\[
\frac{\partial R_g}{\partial \beta} = \alpha (P_e - C_1) + (1-\alpha)(P_e - C_1) - \alpha (P_e - C_2 - F_e) - (1-\alpha)(P_e - C_2) = 0
\]

The profit maximization idea simply argues that the larger the profits, the greater the company’s success. Profit seems to be the only consideration in the concept, which ignores the temporal worth of money. The Nash equilibrium value of the mixed strategy of government regulators and enterprises is obtained as
follows:
\[
\alpha^* = \frac{C_1 - C_2}{F_e} \quad (20)
\]
\[
\beta^* = 1 - \frac{C_g}{F_e + L_1} \quad (21)
\]

Formula (21) shows that the probability of enterprises producing quality and safety food is related to the cost of government supervision, the loss of Government Non supervision and the government’s punishment to the illegal enterprises. Because industrial agglomeration has the characteristics of concentration, regionality and controllability, for a given regulatory frequency \(N_0\), the higher the degree of industrial agglomeration, the lower the government’s regulatory cost (Dou and Zhang, 2015), that is, \(C_g\) is a monotonic decreasing function of \(Agg\).

\[
C_g = f(Agg) \quad (22)
\]

Where \(f\) is a monotone decreasing function. According to the above Assumption and analysis, there are the following propositions.

Proposition 1 the higher the degree of industrial agglomeration of food enterprises, the more conducive to reducing the supervision cost under the fixed supervision frequency. In other words, for the fixed supervision cost, the supervision frequency will increase, and the supervision efficiency will improve, that is, the greater the supervision strength, the greater the probability of enterprises producing quality and safety food. Rent, mortgages, salary, mortgage repayments, licenses, and insurance rates are all fixed expenses. Since these prices do not even change significantly month to month, they’re simpler to plan because when starting a business. Food, hour salaries, and utilities are examples of overhead expenses.

It is proved that \(\beta^* = 1 - \frac{f(Agg)}{F_e + L_1}\) can be obtained by substituting (22) into (21). For a given supervision frequency \(N_0\), \(f\) is a monotone decreasing function, and \(\beta^*\) is a monotone increasing function of \(Agg\). The larger \(Agg\) is, the larger \(\beta^*\) is.

Proposition 1 shows that the government should optimize the management mechanism from both internal and external aspects, such as internal optimization of the regulatory system, external guidance of food industry agglomeration, reducing regulatory costs, improving regulatory efficiency, increasing regulatory efforts, so as to enhance the probability of enterprises producing quality and safety food.

**Internal mechanism of food quality and safety management mode based on the perspective of industrial agglomeration**

**Enterprise level: the internal mechanism of the impact of industrial agglomeration on food quality and safety**

The process of investing time and money to assist entrepreneurs start, extend, or enhance their businesses is known as enterprise development. Enterprise development helps users in making a wage or escaping poverty, as well as promoting long-term economic success for individuals, their families, and their societies. The external economies of scale brought by industrial agglomeration can be summarized into three aspects, namely, talent agglomeration effect (‘human’), cost effect (‘financial’) and technology spillover effect (‘technology’), that is, through the above agglomeration effect on the product quality and safety of food enterprises. The influence of apparently irrelevant occurrences in one country on the economy of other countries is known as the spillover effect. By eliminating hunger and poverty while raising revenue, the spillover influence of external capital can propel the food and agriculture manufacturing industries into a phase of rapid and sustained growth. The specific internal mechanism is as follows: (1) talent agglomeration effect (‘person’). Industrial agglomeration is the external manifestation of productivity agglomeration. As an important factor of production, human capital’s spatial distribution depends on the spatial distribution of productivity. Enterprises in related industries gather in specific areas, which has a huge demand for talents with specific professional skills, so it brings a lot of employment opportunities. At the same time, when the development of enterprises is limited, professional talents can choose to work in other enterprises in the cluster area to obtain greater development space, that is, they have more choice opportunities, and then there is a talent pool in the industrial cluster area. The phenomenon of aggregation in which various sources are combined to provide a broader and more consistent production to fulfil consumers’ needs (Balamurugan et al. 2021). On the one hand, enterprises can easily obtain the required talents according to their own needs in the agglomeration area, which expands the choice space of enterprises for talents and helps to restrain the output fluctuation caused by external shocks; on the other hand, enterprises and talents are both in the agglomeration area, which reduces the degree of information asymmetry in the talent market and improves the matching degree and efficiency. **
between enterprises and talents. According to the existing research, there is a positive correlation between enterprise productivity and product quality of food enterprises. Therefore, in theory, talent agglomeration effect can promote the improvement of product quality of food enterprises. (2) Cost effectiveness. Firstly, there is close specialization and cooperation in the agglomeration area, and it is convenient for enterprises to obtain intermediate goods in the area, which can effectively reduce the production and transportation costs of enterprises (Xuan and Xuan 2012); secondly, the public infrastructure in the agglomeration area can realize large-scale construction and sharing, which can effectively reduce the cost of enterprise construction and use of infrastructure; thirdly, the public infrastructure in the agglomeration area can realize large-scale construction and sharing, which can effectively reduce the cost of enterprise construction and use of infrastructure. For example, the sharing of labor market can reduce the cost of recruitment and training; finally, the phenomenon of information asymmetry among enterprises in the agglomeration area can be alleviated, which can effectively reduce the transaction cost of enterprises in the near geographical area, it is convenient for communication and cooperation between enterprises, and increases the degree of trust. On the one hand, the reduction of enterprise production cost is conducive to improving enterprise productivity (Rosenthal and Strange 2004); on the other hand, the reduction of fixed costs such as enterprise information search cost and supervision cost will make enterprises have more funds for R & D, and then improve the efficiency of fixed cost investment (Helsley and Strange 2007; Ito et al. 2015). According to the previous exploration, enterprise productivity and fixed cost input efficiency are positively correlated with the product quality of food enterprises. Therefore, in theory, cost effect can promote the product quality level of food enterprises. (3) Technology spillover effect. Spatial economics believes that technology spillover effect gradually decreases with the increase of distance, so the agglomeration of enterprises in a certain region is the basis of technology spillover effect. In the agglomeration area, enterprises exchange and spread technology information through business cooperation, employee flow and informal contact and exchange among employees, which is called technology spillover effect. On the one hand, the geographical agglomeration of enterprises builds a platform for scientific research cooperation among enterprises, creates good opportunities for talent and technology exchange among enterprises, effectively disseminates knowledge and technology among enterprises, enhances the overall innovation ability of clusters, and promotes the productivity of enterprises (Heada et al. 1995). On the other hand, the technology spillover brought by the geographical agglomeration of enterprises can reduce the complexity and uncertainty of technological innovation, reduce the cost of new product R & D, accelerate the technological progress of enterprises, improve the success rate of new product R & D, and then improve the efficiency of fixed cost investment. In the previous exploration, enterprise productivity and fixed cost input efficiency are positively correlated with the product quality of food enterprises. Therefore, in theory, technology spillover effect can promote the product quality of food enterprises (Figure 1).

**Government level: the internal mechanism of the impact of industrial agglomeration on food quality and safety**

As a localized production mode, industrial agglomeration has the characteristics of concentration, regionality and controllability. It has become a strategic mode for various countries to achieve quality control. Looking at the development of China’s food industry, there is a low-level competition phenomenon, which is mainly reflected in the low price to obtain meager profits for survival by reducing food quality and safety. It is not through improving productivity to reduce production costs, but through inferior means of competition to occupy the low-end market. The deep reason for this phenomenon is the product differences Price is the only way of competition among enterprises. Because the price allows the business to regulate the competitors, a competitively pricing strategy can assist you avoid losing market share and consumers to rivals. It is regarded as among the most crucial factors for online consumers to evaluate before making a final purchasing behavior. In order to break this vicious industrial environment, we should not only rely on the establishment of a perfect market competition system to eliminate the uncompetitive enterprises through the market, but also rely on the government regulatory departments to strengthen the supervision and punishment mechanism. The supervision efficiency is proportional to the payment, but the administrative cost of this supervision method is very high. Starbird and other studies have found that the effective use of sampling probability and punishment mechanism can reduce the motivation of enterprises for fraud, and strict sampling system can improve the quality of products (Starbird 2000; Starbird and Amanor-Boadu, 2007). However, China’s vast territory, food enterprises are relatively scattered, and the distance between supervision objects is relatively long,
which makes it more difficult to supervise, and the government supervision department is subject to its own people, money and material. It is difficult to achieve comprehensive food quality and safety supervision and inspection due to resource constraints, and improving the effectiveness of supervision has become an urgent problem for government regulators (Wu 2012; Liu and Li 2015). Industrial agglomeration, as an industrial policy formulated by the government, has become an external driving force affecting government supervision. Enterprises are relatively concentrated in geographical areas. On the one hand, it alleviates the situation that the relative strength of government supervision staff is insufficient due to the scattered distribution of enterprises, and also avoids the problem of insufficient supervision effectiveness caused by the excessive workload of supervision staff and the substitution of other departments. On the other hand, it is convenient for the government regulatory departments to set up supervision and inspection institutions in the agglomeration area to provide technical support, reduce the inspection cost through batch inspection, and alleviate the financial and material problems. Therefore, the promotion of industrial agglomeration is conducive to the intensive management of government regulatory departments, thus reducing the cost of administrative supervision, improving the efficiency of supervision, strengthening supervision, and improving the level of food quality and safety (Figure 2).

The realization path of food quality and safety management mode based on the perspective of industrial agglomeration

Reasonably guide the food industry agglomeration and optimize the agglomeration development mode

Although the spatial agglomeration of enterprises is an obvious trend in China’s current economic activities,
and the phenomenon of food industry agglomeration is becoming more and more obvious, the level of agglomeration still needs to be further strengthened, and the scale of agglomeration area still needs to be further expanded. Therefore, the government should guide the food industry to gather in space mainly from the two aspects of resource endowment and external environment. At the same time, the established industrial park should focus on introducing upstream and downstream enterprises matching the industries in the park based on its own advantages. First of all, when the government plans the regional layout of food production, it is suggested that the suburban dairy farms should be moved to the suburban areas or agricultural and pastoral areas close to the feed producing areas, which not only reduces the production cost of raw milk and solves the feed supply problem, but also helps to alleviate the non-point source pollution in the development of dairy farming, improve the food quality and reduce the safety risk Finally, the government guides the enterprises in the industrial agglomeration area by increasing financial support, reducing taxes and other industrial policies, so as to improve the technical level of the food industry and encourage the development of the industry. Encourage enterprises to innovate and produce higher quality and safety products, so as to promote the healthy, healthy and sustainable development of China’s food industry. Because it is still the invisible hand of the market that plays a fundamental role. Therefore, in the development of agglomeration economy, we should fully consider and respect the wishes of enterprises, and give priority to encouragement and guidance. At the same time, local governments should guide industrial agglomeration appropriately to avoid excessive agglomeration.

Give full play to the effect of gathering external economies of scale to promote the safe production of food enterprises

Food enterprises are the most direct providers of food, and their control of quality and safety directly affects and even determines the level of food quality and safety. The research shows that promoting the production and operation to be organized and large-scale is conducive to the external supervision of food quality and safety and the internal self-discipline of enterprises. Therefore, based on the characteristics of the small-scale and decentralized pattern of China’s food industry, on the basis of the role of the market mechanism, through the guidance of the macro policy of industrial agglomeration, the external economies of scale effect of agglomeration can be exerted to promote the food industry to be high-quality and high-end in the development of urbanization. First of all, strengthen the food enterprise staff education and training work. For employees of food enterprises, education and training on food nutrition and health, food safety, food laws and regulations should be carried out to improve their personal quality and professional ability, so as to implement them in food quality work and improve the average level of professional technology of labor market in the agglomeration area. Secondly, carry out food quality and safety information exchange and risk early warning. In order to promote the information communication and exchange within the industry, enhance the overall innovation ability of enterprises in the agglomeration area, find problems, investigate quality risks, and realize the quality risk early warning, we should build a scientific research cooperation platform among the government, industry and enterprises within the enterprise and the agglomeration area, establish a regular formal and informal information communication mechanism, promote the information communication and exchange within the industry, and enhance the overall innovation ability of enterprises in the agglomeration area. Finally, improve the relevant industrial policies and establish incentive mechanism. The food enterprises that produce high quality and safety products will be given incentives and subsidies or preferential tax, financial and other policies to encourage enterprises to further upgrade product quality and safety and provide consumers with higher quality and safety food.

Clarify the allocation of government regulatory resources to ensure the quality and safety of food industry

After several major food safety accidents, the Chinese government regulatory authorities have strengthened the supervision of food quality and safety, but the lack of regulatory capacity due to regulatory resources constraints has reduced the ability to continuously improve the regulatory level. Based on the overall situation of China’s food quality and safety supervision, we should reorganize the supervision logic and adjust the allocation of supervision resources. Firstly, government regulatory resources should be dynamically adjusted with the degree of food industry agglomeration. In other words, the allocation of grass-roots regulatory resources, such as human resources, material resources and financial resources, is the least, so it is difficult to achieve normal management. In the face of the low degree of industrial agglomeration, the government should timely adjust the allocation of regulatory resources, such as human resources, material resources and financial resources, to ensure the quality and safety of food enterprises. Secondly, the supervisory and management authority should be enhanced through the government. In the face of the high degree of industrial agglomeration, the government should be able to dynamically adjust the allocation of regulatory resources and ensure the quality and safety of food enterprises.
resources, strengthen the grass-roots regulatory power, focus on the weak links of food quality and safety supervision, and avoid the low regulatory efficiency caused by resource mismatch. Secondly, increase the investment of supervision funds and improve the quality of supervision personnel. China’s food quality and safety supervision and law enforcement, food safety research need a lot of financial support, government departments should formulate a scientific supervision budget according to the regional population density, enterprise size and financial revenue, and make reasonable and legal use. For the selection of supervisors, it is necessary to build a team according to the selection principle of full-time personnel, and establish a professional food supervision talent team, so as to ensure that the professional ability and law enforcement level of supervisors can meet the actual needs of food quality and safety supervision. Finally, improve the food quality and safety supervision system, and gradually improve the safety standards. The empirical results show that food quality and safety standards will affect the level of food quality and safety. Considering the reality of China's food industry, we should gradually improve the food quality and safety supervision system, improve the food quality and safety standard system, improve the quality and safety standard requirements, and ultimately enhance the threshold of the food industry to ensure food quality and safety.

Acknowledgements
We gratefully acknowledge the financial support from the National Natural Science Foundation of China (grant number 91746202; 71433006; 71373117)

Disclosure statement
No potential conflict of interest was reported by the author(s).

Funding
This work was supported by National Natural Science Foundation of China [grant number: 71373117, 71433006, 9174 6202].

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