"Going global": determinants of Chinese outward foreign direct investment in the agri-food industry

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Abstract:

Growing investment from developing and transition economies flows to global agri-food industry, among which Chinese outward foreign direct investment (OFDI) in the agri-food industry attracted much more global attention in recent years. In this paper, the authors documented the evolution of Chinese OFDI in the agri-food industry from 1950s. Besides, conditional logit model is mainly used to econometrically analyze how the host country characteristics affect Chinese firms' country choices on investing in foreign agri-food industry based on the panel data between 2006 and 2015. Both the conditional logit result and the robustness check (negative binomial result) show that Chinese OFDI in the agri-food industry has both motivations of agricultural resources seeking and market seeking. The result of sub agri-food industries indicates that market seeking motivation is distinct in the agriproduct processing and food manufacturing industries. Chinese OFDI flowing to these two industries are attracted by both GDP and population growth rate. In addition, lack of sufficient food is also an attraction to Chinese OFDI to flow into target country's food manufacturing industry.

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JEL Codes: Q17, Q18

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Abstract

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Key words

Outward foreign direct investment(OFDI), agriculture, food, China

JEL codes: Q13 Q17 Q18

1 Introduction

Globalization of agriculture and food sectors has accelerated in recent years (Jin et al., 2017). The value of cross-border merger and acquisition (M&A) transactions in the agriculture, forestry and fishing industry reached a historical high value of US$ 7.63 billion in 2015, and this figure in the food, beverages and tobacco also reached its record of US$120.60 billion in 2016[1]. Investment Promotion Agencies (IPAs) of developing and transition regions indicate that agriculture, food and beverages are among the most promising industries for attracting foreign direct investment (FDI) to their countries for the two consecutive years (UNCTAD, 2016, 2017).

In agriculture related sector, developing countries are also expanding their international influences through overseas investment. From 1990 to 2007, world outward FDI (OFDI) stock in agriculture, hunting, forestry and fishing sector increased 170%, while OFDI stock of developing economies increased 690% (UNCTAD, 2009). The similar growth gap also existed in food, beverages and tobacco sector. As an important developing country, China is expanding overseas agricultural investment. For example, in 2013, Shuanghui International acquired Smithfield; China Oil & Foodstuffs Corporation (COFCO) acquired Nidera and Noble Agri. from 2014 to 2016; China National Chemical Corporation (ChemChina) accomplished the acquisition of Syngenta in 2017. Besides M&A, Chinese enterprises also start their overseas business in the agriculture related sector in other forms, such as developing untapped resources in less-developed regions like in Southeast Asia and Africa (Gooch and Gale, 2015). Since 2008, Chinese OFDI in agriculture sector has been steadily growing (see Fig. 1).

(Fig. 1 here)

China's booming overseas investment in the agri-food[2] sector has its own driving force. Since its agricultural reform in 1978, China has made great progress in boosting food production (Carter et al., 2012). However, the gap between domestic food supply and

[1] Source: UNCTAD, World Investment Report 2017: Annex Tables (Table 14- alue of cross-border M&A purchases, by sector/industry, 1990-2016), released on 07 June 2017.
http://unctad.org/en/Pages/DIAE/World%20Investment%20Report/Annex-Tables.aspx

[2] Agri-food sector (industry) in this paper refers to crop and economic trees planting (planting for short), livestock, fishery, agriproduct processing and food manufacturing industries. Forestry, beverages and alcohol industries are not included.

demand will continue to expand (Cheng and Zhu, 2014; Huang et al., 2012). China's growing population, urbanization, and upgrading of dietary structure (rising ratio of animal protein in total food intake) caused by increasing income, will lead to continuous rising demand for food in the future decades (Chen, 2007; Fuller et al., 2006; Ghose, 2014; Ortega et al., 2009). Nevertheless, the restriction and pollution of cultivated land and water resources, growing farmers flowing into non-agricultural sectors and the excessive use of fertilizers limit the production potential of high-quality food (Fan and Brzeska, 2014; Rozelle et al., 1997). This conflict between domestic food supply and demand requires China to rely on the international market to fulfill the increasing domestic food demand and consequently China has become an important player in investing foreign agriculture (Lin, 2015).

Under such circumstances, global interests arise in Chinese overseas agri-food investment (Brautigam, 2015; Gooch and Gale, 2015). A large part of existing studies focusing on land-based investment. Hofman and Ho (2012) systematically summarized the history of Chinese overseas land-based investment in agriculture from 1949 to 2011 and distinguished different categories of actors. Besides, some research analyzed the developing path of Chinese agri-land investment in specific foreign regions, and made in-depth discussions on the economic, social and technological influences on the host countries generated by Chinese investment. For example, Brautigam and Zhang (2013), Friis and Nielsen (2016) and Puyana and Costantino (2015) have investigated Chinese agri-land investment in Africa, Laos and South America, respectively. Another series of studies discussed typical Chinese overseas M&A cases (e.g., Jin and Zhang, 2014; Xia, 2015; Zhang et al., 2017). Boys and Kandilov (2016) analyzed the determinants of Chinese agri-food sector OFDI using similar factors as those in the whole manufacturing industry. Almost all the existing studies payed attention to the resource seeking motivation of China's foreign agri-food investment, for example, Friis and Nielsen, 2016; Hofman and Ho, 2012; Puyana and Costantino, 2015.

The objectives of the paper are twofold. First, this paper aims to briefly introduce the history of Chinese agri-food sector "going global". Second, this paper aims to investigate the determinants of Chinese agri-food OFDI from the perspective of host

country characteristics and include agriculture specific variables to mainly focus on the motivations of Chinese agri-food OFDI. Third, this paper empirically investigates whether Chinese firms have resource seeking motivation and foreign market motivation as well. Moreover, this paper will compare the differences of host country determinants in different subsectors such as crops and economic tree planting, livestock, fishery, agriproduct processing and food manufacturing industries.

The rest of this paper is organized as follows: in Section 2, a general picture is shown on the background and characteristics of Chinese agri-food sector "going global" in different time stages. Then an econometric model is constructed to investigate how host country characteristics impact the destination country choice of Chinese OFDI in the agri-food sector. Model, data and empirical results are detailed displayed in Sections 3 and 4. The last section will briefly draw the key conclusions and discuss future research interests.

2 Background of Chinese agri-food sector "going global"

Chinese agriculture "going global" dates back to late 1950s, and in the early stages the major form is foreign assistance aid. National and provincial state-owned agribusiness companies helped agricultural development of African and Southeast Asian countries by joint exploitation or providing technical support. Since China's economic reforms in the early 1980s, the operation of foreign agricultural projects have become more commercialized that firms participate in the global agricultural cooperation projects by competitive bidding. Different from previous government assistance, projects in this period aimed at achieving an economic win-win situation for China and host countries, so Chinese investors gain profits from operating farms abroad. Since 1990s, small and medium-sized investors began to invest in overseas agriculture, such as planting crops in neighboring countries.

In 2001, Chinese government adopted the strategy of agriculture "going global" and encouraged firms with strength to develop agricultural resources abroad. Apart from that, the upgrade of Sino-African, Sino-ASEAN and Mekong River basin cooperation also promoted Chinese OFDI in agriculture of African and Southeast Asian countries. From then on, growing private actors participated in foreign agri-food investment. The target industry not only included crop farming but also extended to animal breeding, agriproduct

processing and food manufacturing. Table 1 summarizes the background, main investment actors, destinations and content of different sub agri-food industries "going global" at various stages.

(Table 1 here)

In recent years, grain imported from international market continued to rise to feed the aquaculture, poultry, dairy and livestock sectors. However, the sharp rise of international food price in 2007 indicated that it may harm Chinese domestic food price stability if China relies much on direct foreign cereal import from foreign grain traders. Under this circumstance, in 2008 Chinese central government suggested that China should establish a stable and reliable grain import supply system by encouraging agricultural enterprises to invest in foreign countries. Since then, China's agriculture "going global" strategy has become one of the important tasks of national agricultural development. From 2014 to 2017, Chinese central government mentioned every year in its guidance documents that China should make full use of international agricultural resources and markets, establish stable cooperative relations with major grain producer countries, cultivate internationally competitive agribusiness enterprises and encourage firms to set business overseas, especially in countries along the "One Belt, One Road" path. Under the support of the government, COFCO, which had served the national grain and oil trade for several decades, acquired Australia's largest sugar producer Tully in 2011, and then acquired two international grain dealers - Nidera and Noble Agri from 2014 to 2016. COFCO aims to be an international agribusiness conglomerate that can make an influence on the global food supply chain.

Between 2010 and 2015, encouraged by Chinese government's agriculture "going global" stimulation policy and also influenced by continuous appreciation of Chinese Yuan[3], Chinese OFDI in agri-food industry grew rapidly. In recent years, China's overseas agri-food investment has undergone the following major changes. First, not only agri-food companies start foreign business, non-agricultural enterprises or investment companies also invest in overseas agriculture with various motivations. Second, destination countries

[3] The exchange rate of Chinese Yuan to U.S. dollar kept rising from 2005 to July, 2015.

shift from developing countries with abundant undeveloped agri-land to developed countries such as Australia, Europe and the United States. Third, more and more enterprises choose to set overseas business through M&A, rather than greenfield investment, which was the most common investment pattern in the past. At present, the major industries and features of Chinese OFDI in agriculture throughout the world are shown in Table 2.

（Table 2 here）

3 Estimation strategy and Data

3.1 Conditional logit model

In order to explore the determinants of Chinese agri-food OFDI, a conditional logit model (CLM) developed by McFadden (1974) is constructed to investigate how natural resource endowments and socio-economic factors of the host countries influence the country choice of Chinese firms.

The basic premise of the conditional logit model is that a rational Chinese firm would choose a host country as the destination of overseas agri-food investment only if this country offers the highest profit among all the possible choices. Let π_{ijt} be the perceived profit that Chinese firm *i* can make if it invests in country *j*'s agri-food industry at year *t*. Assume that π_{ijt} has the following deterministic function:

$$\pi_{ijt} = \beta X_{jt} + \varepsilon_{ijt} , \qquad (1)$$

where X_{jt} is a vector of characteristics of country *j* at year *t*, such as agricultural resources, market size, distance and institutional environment, etc; and ε_{ijt} is a disturbance term.

According to the principle of maximizing its own profits, firm *i* will choose country *j* to invest in its agri-food industry only if the expected profit earned in country *j* is the highest, i.e., the probability of Chinese firm *i* investing in the agri-food sector in country *j* is given by:

$$P_i(j) = Prob\left(\pi_{ijt} \geq \pi_{ikt}, \quad \forall k \neq j\right)$$

$$= Prob\left(\pi_{ijt} - \pi_{ikt} \geq 0, \ \forall k \neq j\right)$$

$$= Prob\left(\varepsilon_{ijt} - \varepsilon_{ikt} \geq \beta X_{kt} - \beta X_{jt}, \ \forall k \neq j\right) , \qquad (2)$$

where j, k ∈ J, and J is the set of all the potential alternative investment destination countries[4]. Assume that ε_{ijt} follows Type I extreme value distribution, then the probability function (2) can be simplified as:

$$P_i(j) = \frac{e^{\beta X_{jt}}}{\sum_{k=1}^{J} e^{\beta X_{kt}}} \ , \tag{3}$$

The coefficients β of conditional logit model can be estimated by the maximum likelihood method.

One precondition of getting unbiased estimators of conditional logit model is that the data should follow IIA (independence of irrelevant alternatives) assumption. However, the data we apply may violate IIA assumption since destination countries may be similar to investors in some way. For the robustness test, we will apply another location choice model that is also widely used in empirical research - Poisson model (Guimarães et al., 2004; Schmidheiny and Brülhart, 2011).

In Poisson model, the dependent variable changes to the newly established Chinese foreign affiliates number in different target countries in each year. The precondition of using Poisson model is that the variance and expectation of the dependent variable is equal. However, the number of OFDI deals in 104 countries - the dependent variable, is over dispersion, which may lead to biased estimation if using standard Poisson regression model. To solve this problem, this study applies a negative binominal econometric model (NB), a revised method of Poisson model, to obtain the estimators as previous studies (Boys and Kandilov, 2016; Jin and Tokunaga, 2007).

3.2 Variables

The focus of the paper is embraced on the two main motivations of Chinese firms' agri-food OFDI: agricultural resources seeking and foreign markets seeking. Specifically, the two motivations can be described from the following different perspectives.

[4] The potential alternative investment destination countries refer to 104 countries where Chinese firms have agri-food investment record in the data the authors applied.

(1) Agricultural resource seeking. The foreign agricultural resources that Chinese enterprises aiming at can be divided into two categories: input resource and agriproduct resource.

First, by developing land and other agricultural input resource, Chinese enterprises can increase agricultural output or lower production costs to fulfill the increasing food need of China. Input resource of host countries can be expressed by the natural logarithm of agricultural land (*Ln(AgriLand)*).

However, developing agriculture from scratch always costs plenty of money and time, especially in regions where natural conditions are challenging for agriculture. Therefore, some firms aim at abundant and diverse existing agriproducts overseas for strategic needs. Chinese firms can gain control of overseas agricultural products resource by equity investment. Agriproducts production value per capita of the host country (*ProdAgri_pc*)[5] is used to describe agriproduct resource seeking motivation.

(2) Foreign markets seeking. Some firms produce agriproducts and food in countries with market potential and make profit from selling in the host countries. Foreign market seeking motivation can be measured from two perspectives: current market size and future market potential. Current market size is measured by natural logarithm of real GDP of target country (*Ln(GDP)*, deflated to 2011 level).

Future market potential is measured by population growth rate (*Pop_gr*) and calories provided by food per capita per day (*Foodsupply_pc*). It is reasonable to assume that high population growth rate is related with more children and young people in the future several decades, leading to increasing need for food. The countries where people do not have sufficient food intake are also the regions with greater potential agri-food market. Therefore, Chinese firms will be proved to have motivations to explore potential foreign agri-food market if the *Pop_gr* is significantly positive or *Foodsupply_pc* is significantly negative.

[5] In different sub agri-food industries, the main agriproducts category differs from each other. See 3.3 Data for more details.

Last, to alleviate the influences of omitted variables that potentially correlate with risk and cost of running business overseas, a series of control variables are also included in X_{jt} . The following variables are constructed based on previous studies (Buckley et al., 2007; Kang and Jiang, 2012; Kolstad and Wiig, 2012): (a) Country and time average (for the past 5 years) Chinese agri-food OFDI numbers in region *r* that country *i* belongs to. This variable is used to control for the unobservable region effects that may attract Chinese agri-food OFDI. It is described as $OFDIN\_region_{irt} = \frac{\sum_{t-6}^{t-1}\sum_{all\ j\in r} OFDIN_{jrt}}{5\times n_{j\in r}}$, where $OFDIN_{jrt}$ represents numbers of Chinese newly established agri-food affiliates in country *j* (that belongs to region *r*) at year *t*, and $n_{j\in r}$ refers to the total country numbers in region *r* that country *j* belongs to; (b) According to the gravity model of trade, distance influence bilateral investment. Therefore, the natural logarithm of distance between the capitals of host countries and China (*Ln(Distance)*) is included, which is related to transportation and management costs, and cultural differences as well; (c) The exchange rate of Chinese Yuan to host countries' currency (*RCNY*) will influence the relative investment cost; (d) Economic freedom index (*EFI*) calculated by Heritage Foundation; (e) FDI openness, the ratio of FDI inflows to GDP (*IFDI/GDP*); (f) Political stability and absence of violence/terrorism released by World Bank (*PoliStability*); (g) Infrastructure development level, measured by internet users per 100 people (*InternetUse*).

3.3 Data

The data of dependent variable is from "Cross-border Investment Firm List" released by Ministry of Commerce, P. R. China[6]. It contains 42061 Chinese overseas affiliates' details from 1970 to 2015. The list includes information on the approval date, the firm name and regional origin of Chinese investors, and the name, destination region and business description of affiliates overseas. The authors pick out samples related to agri-food investment according to the business description of foreign affiliates, and delete those firms that set affiliates in tax haven regions (Bermuda, British Virgin Islands, Cayman Islands

[6] The data is downloaded by the authors from website: http://wszw.hzs.mofcom.gov.cn/fecp/fem/corp/fem_cert_stat_view_list.jsp. Accessed in February 2016.

and Cook Islands), China Hong Kong, Macau and Taiwan. In final, this study includes 1587 agri-food affiliates' details in 104 foreign countries from year 2006 to 2015.

Fig. 2 a, b and c represent numbers of Chinese newly established agri-food affiliates around the world in 2005, 2010 and 2015, respectively. As shown in Fig. 2, Chinese agri-food OFDI grew fast in the last decade. Destination countries mainly locate in Asia, Oceania and North America, and increasing OFDI flowed to European and African countries in the past 10 years.

(Fig. 2 here)

Country-level independent variables are derived from FAO, Word Bank, IMF and other international organizations. The region classification used to calculate variable $OFDIN\_region$ is according to the geographical division of FAO, and the country level Chinese newly established agri-food affiliates $OFDIN_{jrt}$ is calculated based on the "Cross-border Investment Firm List" data as mentioned above.

As this paper will also investigate the impact of host country determinants on Chinese OFDI in several sub agri-food industries, the indicators of some independent variables vary in different sub agri-food industry equations. This study uses gross production value of crops per capita, gross production value of livestock per capita, production of fish, seafood per capita, gross production value of agriculture per capita and gross production value of food per capita to measure agriproduct resource when estimating the influences on OFDI in farm, livestock, fishery, agriproducts processing and food manufacturing industries, respectively. The sources and descriptive statistics of dependent and independent variables are shown in Table 3, and details about how the missing data are supplemented are in the notes. Table 4 displays the correlation matrix of all independent variables.

(Table 3 and Table 4 here)

4. Results and discussion

4.1 Results for overall agri-food industry

Table 5 presents the main estimation results by using conditional logit econometric model. The results of Pseudo R^2 and Prob > chi^2 indicate that the models fit well. Column (1) of

Table 5 displays the empirical results for the host country characteristics' influences on Chinese firms' country choice in the overall agri-food industry. As expected, Chinese OFDI in the agri-food industry does have strong agricultural resource seeking motivation. The variables referring to resources, *Ln(AgriLand)* and *ProdAgri_pc* are very significantly positive in column (1), indicating that Chinese OFDI in the agri-food sector is strongly motivated by the abundant agricultural resources of the host countries. The more agricultural land and agriproducts the host country possesses, the higher possibility Chinese firms have to invest in its agri-food industry.

(Table 5 here)

In addition, Chinese firms' investment decision is also determined by foreign agri-food market size and potential. The estimated coefficient of market size variable *Ln(GDP)* in column (1) is positive at 0.177 and highly significant (with a standard error of 0.024). This indicates that if the destination has larger market size, Chinese firms is more likely to invest in the agri-food industry of that country. In addition, market potential of foreign countries' agri-food industry is also an important consideration of Chinese firms. Population growth rate (*Pop_gr*) is significant at 0.05 level, meaning that Chinese firms prefer to invest in countries with rising population, i.e., growing need for food. This result is consistent with the strong foreign market orientation of American food firms' overseas investment found in previous studies (e.g., Handy and MacDonald, 1989; Makki and Somwaru, 2004; Ning and Reed, 1995; Skripnitchenko and Koo, 2005).

For the control variables, most of them show significant influences on Chinese firms' location decision on investing overseas agri-food industry. As expected, regional agri-food investment concentration (*OFDIN_region*) is significantly positive. *Ln(Distance)* is significantly negative, suggesting that long distance from China will reduce the possibilities of Chinese firms' investing abroad since management and shipping costs are higher and linguistic and cultural barriers can be a major problem if firms invest in countries far away. The significantly positive sign of FDI openness (*IFDI/GDP*) and political stability (*PoliStability*) both indicate that Chinese firms are more willing to invest in countries with more open and better political environment.

Different from expectation, the coefficient of economic freedom (*EFI*) is negatively significant. This suggests that free economic environment is a main consideration for Chinese firms to invest in foreign agri-food industry. On the contrary, those less developed countries with better resource endowment and market potential (while these countries' EFI is always low) may be more attractive for Chinese agri-food OFDI. The insignificance of *RCNY* may be because Chinese Yuan's exchange rate kept stable during 2006-2015, leading to difficulties to see the potential impact of exchange rate on OFDI.

4.2 Results for different sub agri-food industries

Agri-food industry covers a wide range of areas, including farming of the primary industry, food manufacturing of the secondary industry and some business may even relate to providing service. Not only the core competitiveness of every sub agri-food industry is different from each other, but also the resource status and development level of different sub industries in China and overseas countries may vary. It is necessary to analyze the factors that affect Chinese OFDI separately for different sub-sectors.Columns (2) - (6) of Table 5 display the results for the impact of host country characteristics on Chinese OFDI in crops and economic trees planting, livestock, fishery, agriproduct processing and food manufacturing industries, respectively.

Two variables related with resource abundance (*Ln(AgriLand)* and *AgriProd_pc*) generate similar effects on OFDI in all sub industries, indicating that the impact of agricultural land resources and agriproduct resources on OFDI in each sub industry is stable. The coefficient of *Ln(AgriLand)* variable ranks highest in column (3) and ranks second in column (2), suggesting that the impact of agricultural land on Chinese OFDI in livestock and planting industry is greater than that in the other industries. This result is easy to understand because one of the most important inputs of these two sub agri-food industries is agricultural land.

Three variables related with foreign market seeking motivation have different influences on Chinese OFDI in different sub industries. *Ln(GDP)* is significantly positive in the fishery, agriproducts processing and food manufacturing industry (column (4) - (6)), indicating that Chinese OFDI tends to invest in these sub agri-food industries in countries

with higher income. Population growth rate (*Pop_gr*) is significantly positive in agriproducts processing industry and food manufacturing industry (column (5) and (6)), and food intake (*FoodSupply_pc*) is significantly negative in food manufacturing industry (column (6)). We can see from the results that market seeking motivation of Chinese is very distinct in agriproducts processing and food manufacturing industries. This may be because the products of agriproducts processing and food manufacturing industries mainly go to the final consumer market, and accordingly investors will choose host countries with great market size and future potential to get nearer to consumption market. Moreover, the negative sign of *FoodSupply_pc* in columns (6) indicates that countries with insufficient food will attract Chinese investors to invest in their food manufacturing industry to provide adequate food for local market.

On the whole, the results of different sub agri-food industries show that Chinese firms investing in foreign planting and livestock industries are mainly attracted by the agricultural resources overseas; Chinese firms investing in foreign fishery, agriproducts processing and food manufacturing industries have both resource and market seeking motivations. Specifically, foreign market seeking motivation of food manufacturing industry is strongest among all the sub agri-food industries. The countries with larger GDP, higher population growth rate or less food intake will all attract Chinese firms to invest in their food manufacturing industry.

4.3 Robustness check

As mentioned in Sector 3.1, we use negative binominal model as a robustness test. The results of NB estimators are shown in Table 6. Maximum likelihood method is applied to estimate the NB econometric model. The LR test result suggests that the applied data is over dispersed and negative binominal econometric method other than standard Poisson model is preferred. Moreover, since the data applied is panel data, pooled negative binominal method and random effect (RE) negative binominal method can be used to obtain the estimators[7]. The values of Lagrangian multiplier (LM) test in all equations are significantly different from zero, indicating that RE method is more preferable. Besides,

[7] A fixed effect (FE) model cannot be used since the variables mainly differ among different countries and variable *Ln(Distance)* even kept the same during 2006-2015.

year dummy is also included in NB regression model to control for the growing trend of Chinese OFDI in agri-food industry.

(Table 6 here)

On the whole, the result of NB model is consistent with our main result reported in Section 4.1 and 4.2. Agricultural resource variables are significantly positive in overall agri-food industry and most sub agri-food industries. This indicates that foreign abundant raw materials and agriproducts resources are important considerations for Chinese OFDI's decision on the country choice. Besides resource seeking motivation, agriproducts processing industry and food manufacturing also have market seeking motivation since foreign market seeking variables show significance in column (5) and (6) in Table 6. The NB model result even shows that Chinese firms would like to invest in the planting and food manufacturing industry in countries without sufficient food for the significantly negative sign of *FoodSupply_pc* in column (2) and (6).

5. Conclusion

In recent years, Chinese OFDI in the agri-food industry has experienced explosive growth. After summarizing the history and current situation of Chinese agri-food industry "going global", this paper empirically analyzes how the characteristics of host countries affect the location choice of Chinese OFDI in the agri-food industry.

Chinese agriculture "going global" has a history of more than fifty years. In the early stages, state-owned agribusiness companies were the main actors to provide agricultural assistance for the less developed countries in Africa and Southeast Asia. After China's economic reform, more and more private agri-food firms with strength began to expand their overseas business. For the recent ten years, Chinese OFDI in the agri-food industry has grown rapidly under the encouragement policy released by Chinese government. In this period, investors, destination countries and investment modes all present multiplex tendency. The development history reveals Chinese OFDI in the agri-food sector is becoming more and more diversified.

Based on the 2006-2015 data by matching "Chinese cross-border investment firm list" and characteristics of 113 invested host countries, this paper uses conditional logit

model to investigate the effects of the input resources, agriproduct resources, and foreign market factors on Chinese OFDI in the agri-food industry. To increase the reliability of the main result, this paper also uses negative binominal model as robustness test.

The econometric results show that Chinese OFDI in the agri-food industry has strong motivations of input resources (agricultural land) and agriproduct resources seeking. This fact reveals that Chinese government's policy which encourages Chinese firms to invest in foreign agri-food industry is effective, since Chinese OFDI in the agri-food sector greatly aims at overseas abundant agricultural resources. In addition, Chinese firms also consider market size and potential as important factors when choosing target country to invest in its agri-food industry. Furthermore, if separating the samples by sub agri-food industries, market seeking motivation is mainly shown in the agriproduct processing and food manufacturing industries. Besides high GDP and population growth rate, lack of sufficient food is also an attraction to Chinese OFDI to flow into target country's food manufacturing industry.

This paper presents the overview of Chinese OFDI in the agri-food industry, and explores the factors influencing country choice decision, revealing several key motivations of Chinese firms to invest in foreign agri-food industry. Many other interesting topics need to be investigated in the future about Chinese OFDI in the agri-food industry, such as the characteristics of different investment actors, the choice of entry mode into host countries, and the relationship between OFDI and international trade of agriproducts.

Tables

Table 1 Chinese sub agri-food industries "going global" at different time stages

Industry	Time	Relative background	Main target regions	Actors	Form, content and development	Representative cases
Land based farm production (crop and economic tree planting and pasturing)	1950-1980	China wanted diplomatic supports from African countries in the international arena.	Africa, neighboring Southeast Asian countries	National and provincial state-owned agribusiness companies	Joint agricultural exploitation, technical aids.	Xinjiang Production and Construction Corps went to Tanzania and Somalia to provide agricultural aids; Guangdong Farm Group assisted Vietnam, Cambodia and Mali.
	1980-1999	Economic reform promoted the marketization of aid projects.	Mainly to Africa and Southeast Asia; expand to Australia, South America	National and provincial state-owned agribusiness companies, private investors	Firms participated in the global agricultural cooperation projects by competitive bidding. Farming enterprises managed foreign farms by purchasing or renting land. Small and medium investors began to farm abroad.	Chinese State Agribusiness Corporation purchased a farm in Queensland, Australia; Xinjiang Xintian Group grew rice in Cuba and Mexico; Heilongjiang farmers went to Russia to grow crops; Zhejiang private enterprises invested in African farms.
	2000-2008	Sino-African, Sino-ASEAN and Mekong River basin cooperation deepened.	Africa, Mekong River basin, Southeast Asia	State-owned farming enterprises, private investors	Facilitated by regional cooperation, investment to some regions increased.	Small and medium investors near the border invested in Southeast Asia planting cassava, palm oil, sugarcane and other crops.
		2007-2008,global financial crisis lasted.			OFDI in agriculture slowed down.	
	2009-2015	Financial crisis ended. Chinese Yuan continued to appreciate. China participated in "South-South" cooperation. Agricultural resources limitation restricted production. Domestic attention on food	Expand to Latin America,Pacific countries, Central Asia, Eastern Europe, as well as to industrialized countries like Australia and France	Agricultural firms, private investors, non-agricultural firms	Farming enterprises continued to operate. Firms that in the downstream sectors of agriculture industry invested in foreign agriculture. Non-agricultural enterprises or investment companies invested in agriculture of agriculture-developed countries by acquiring farms and vineyards.	Ashley produced milk powder by setting new pastures in New Zealand. Shanghai Pengxin bought a dairy ranch in New Zealand. Shandong Ruyi Technology (textile industry) bought farms to plant cotton in Australia. Ningbo Moon Lake Investment Company (owned by individual)

Industry	Time	Relative background	Main target regions	Actors	Form, content and development	Representative cases
		safety increased.				bought an Australian dairy farm.
Intensive animal breeding (poultry, hogs, freshwater aquaculture)	2002-2015	Animal breeding in neighboring developing countries is less developed and the market is not saturated.	Mainly to neighboring developing countries and Africa and a few to U.S.	Mainly breeding enterprises and some feed enterprises	Firms mainly set new livestock farms to produce for local market.	
Marine fishery	1985-1999	China started the survey on foreign marine fishery resources. Offshore fishing of developed countries gradually declined due to high labor costs.	Expand from West African countries to 39 countries around the world. But more than 90% is developing near the coast.	Fishery enterprises	Developing phase: Offshore fishery enterprises increased from 0 to more than 60, with high annual output growth. China became one of the major oceanic fishing countries in the world. Fishing vessels are outdated and cannot be applied for fishing in open sea.	In 1984, China established Zhongda Fisheries Co., Ltd. with an Italian company and set up the first offshore fishing fleet.
	2000-2015	The ministry of Agriculture adjusted the structure of developing marine resources.	Started to develop fishery resources in open sea.	Fishery enterprises	Structure optimization： Give priority to the development of oceanic fisheries, focusing on open seas fishery resources.	

Industry	Time	Relative background	Main target regions	Actors	Form, content and development	Representative cases
Feed	2000-2015	In late 1990s, China's domestic feed industry competition was very intense and firms' profit margins declined. While there is great market potential in Southeast Asia.	Mainly to Southeast and Mid Asia; some to Russia and Europe	Large and medium feed enterprises	Started around 2000 and speeded up after 2007. Firms mainly set new feed processing factories for serving local market.	New Hope Group owns more than 40 feed factories in over 20 countries around the world since its first investment in Vietnam in 1999.
Agriproduct processing and food manufacturing	2003-2010		Mainly to Neighboring countries.	Small and medium-sized food enterprises, industry and trade companies	Small and medium-sized food enterprises mainly produced spices, aquatic products and dairy products in neighboring countries, and produced Chinese traditional food in some other countries.	In 2003, Shanghai Food set up joint factory to produce Chinese cooked food in Canada.
	2011-2015	Chinese Yuan continued to appreciate. Chinese consumers' requirements on food safety and quality increased.	Neighboring countries and some developed countries	All kinds of food firms	Small and medium-sized food enterprises continued to produce overseas.Large food companies implemented international strategy by setting subsidiaries in developing countries and acquiring mature food firms in industrialized countries.	Bright Food acquired food enterprises of U.K., Israel and New Zealand. Shuanghui International acquired Smithfield of U.S.; Tsingtao Beer set joint ventures in Thailand.

Table 2 Features of Chinese OFDI in the agri-food industry in different regions around the world

Region	Region features	Main target industries	Main motivation	Investors	Entry mode
Japan, South Korea	High consumption level, limited agricultural resources, high labor costs	Food processing and manufacturing	Market	Food firms	Mainly green field
Southeast Asia	Tropical climate, great market potential	Tropical crops	Resource	Agricultural firms, private investors	Mainly green field
		General crops	Resource, market		
		Intensive animal breeding, food manufacturing	Market	Husbandry and food firms, private investors	
		Feed	Market	Feed enterprises	
Russia and Mid-Asia	Abandoned land	Cereals	Resource	Agricultural firms	Mainly green field
Africa	Abundant agricultural land resources, backward agricultural development	General crops	Resource, market	Agricultural firms	Technological cooperation, green field
		Intensive animal breeding; food manufacturing	Market	husbandry and food firms, private investors	Mainly green field
		Feed	Market	Feed enterprises	
South America	Abundant agricultural resources, high agriproducts output	crop farming, pasture	Resource	Agricultural and food firms	Mainly M&A and orders, a few green field
Australia, North America	Developed agriculture, high consumption level, advanced technology and management	Pasture, crop farming	Resource Technology	Agricultural and food firms, non-agricultural investors	Mainly M&A
		Food manufacturing	Market Technology	Food firms	Mainly green field

Information resource: the authors' summary based on literatures, 'China's foreign agricultural investment and cooperation report (2015)', 'Cross-border Investment Firm List' and news.

Table 3 Summary of statistics

Variable	Description		Obs	Mean	Std. Dev.	Min	Max	Source
Dependent variables								
Investment Indicator	Firms' decision of whether to invest in a certain country's agri-food industry							
	Overall agri-food industry[a]		164,517	0.009	0.095	0	1	Cross-border Investment Firm List
	Planting[a]		47,046	0.009	0.095	0	1	
	Livestock[a]		7,149	0.010	0.098	0	1	
	Agriproducts processing[a]		19,161	0.009	0.093	0	1	
	Food manufacturing[a]		29,081	0.009	0.096	0	1	
	Fishery[a]		16,709	0.009	0.093	0	1	
Investment motivation variables								
Motivation - Input resource								
Ln(AgriLand)[b]	Natural logarithm of Agricultural land (km^2)		1,044	11.304	2.143	4.369	15.286	FAOSTAT
Motivation - Agriproducts resource								
ProdAgri_pc[c]	Agriproducts production value per capita							
	Overall agri-food industry	Gross production value of agriculture per capita (constant 2004-2006 1000 International $/ capita)	1,044	0.357	0.322	0.018	2.599	FAOSTAT, WDBI
	Planting	Gross production value of crops per capita (constant 2004-2006 1000 International $/ capita)	1,044	0.203	0.132	0.010	0.750	
	Livestock	Gross production value of livestock per capita (constant 2004-2006 1000 International $/ capita)	1,044	0.153	0.248	-0.004	2.301	

	Agriproducts processing	Gross production value of agriculture per capita (constant 2004-2006 1000 International $/ capita)	1,044	0.357	0.322	0.018	2.599	
	Food manufacturing	Gross production value of food per capita (constant 2004-2006 1000 International $/capita)	1,044	0.346	0.315	0.018	2.530	
	Fishery	Production of fish, seafood per capita (tonnes/ capita)	1,044	0.037	0.089	0	1.039	
Motivation - Foreign market size								
Ln(GDP)	Natural logarithm of GDP (US $), GDP is deflated to year 2011 by GDP deflator (base year varies by country)		1,044	24.466	2.411	18.466	30.372	WDBI
Motivation - Future market potential								
Pop_gr	Population growth (annual %)		1,044	1.591	1.454	-1.691	15.033	WDBI
FoodSupply_pc[c]	Grand Total-Food supply (million kcal/capita/day)		1,044	2.807	0.462	1.554	3.783	FAOSTAT
Control variables								
OFDIN_region	Past 5 years' country average Chinese agri-food OFDI numbers in a certain region							
		Overall agri-food industry	190	0.601	1.078	0	8.100	Cross-border Investment Firm List
		Planting	190	0.130	0.305	0	2.000	
		Livestock	190	0.029	0.058	0	0.400	
		Agriproducts processing	190	0.057	0.110	0	0.564	
		Food manufacturing	190	0.136	0.257	0	1.400	
		Fishery	190	0.106	0.261	0	2.400	
Ln(Distance)	Natural logarithm of distance between the capitals of host countries and China's capital, Beijing (km)		1,044	8.943	0.553	6.862	9.868	CEPII
RCNY	Current exchange rates, annual average (100CNY)		1,044	1.318	4.443	0.000	46.586	UNCTAD

EFI	Economic Freedom Index	1,044	59.226	9.811	21.440	83.100	The Heritage Foundation
IFDI/GDP	Inward flows of FDI to target country/ target country GDP	1,044	0.045	0.061	-0.084	0.567	
PoliStability	Political stability and absence of violence/terrorism	1,044	-0.191	0.920	-2.810	1.525	WDBI
InternetUse	Internet users (per 100 people)	1,044	31.762	28.639	0	104.246	

Notes:

a) We distinguish sub agri-food industries according to the business description of foreign affiliates. However, some business descriptions cover more than one sub agri-food industry, so these items are included in overall agri-food industry while cannot be categorized into specific sub agri-food industry. Accordingly, the observations of the overall agri-food subsidiaries is larger than the sum of observations of five sub agri-food industries.

b) Since the FAOSTAT database updates to year 2014, the value of agricultural land of year 2015 is represented by the data of year 2014.

c) Since the FAOSTAT database updates to year 2014, we use the average total agriproducts production increase for the past two years to estimate the agriproducts increase amount of 2015, i.e., $AgriProducts_{i,2015} = AgriProducts_{i,2014} + (AgriProducts_{i,2014} - AgriProducts_{i,2012})/2$. The same method is also used to estimate the FoodSupply_pc value of 2014 and 2015 (Grand Total-Food supply only updates to 2013).

The other certain missing values in the country-level data are estimated by linear regression method or average values of neighboring years if reasonable.

Table 4 Correlation matrix of independent variables

	Ln(AgriLand)	ProdAgri_pc	Ln(GDP)	Pop_gr	FoodSupply_pc	OFDIN_region	Ln(Distance)	RCNY	EFI	IFDI/GDP	PoliStability	InternetUse
Ln(AgriLand)	1.00											
ProdAgri_pc[a]	0.22	1.00										
Ln(GDP)	0.49	0.39	1.00									
Pop_gr	0.02	-0.37	-0.36	1.00								
FoodSupply_pc	0.03	0.48	0.62	-0.44	1.00							
OFDIN_region[a]	0.03	0.10	0.17	-0.19	0.09	1.00						
Ln(Distance)	0.11	0.14	-0.12	0.14	-0.04	-0.44	1.00					
RCNY	0.09	-0.02	-0.03	-0.01	-0.06	0.23	-0.23	1.00				
EFI	-0.01	0.43	0.52	-0.28	0.54	0.19	-0.07	-0.25	1.00			
IFDI/GDP	-0.05	-0.16	-0.33	0.16	-0.24	-0.06	0.08	0.01	-0.12	1.00		
PoliStability	-0.32	0.37	0.15	-0.26	0.40	0.20	0.01	-0.06	0.52	0.03	1.00	
InternetUse	0.02	0.53	0.71	-0.45	0.74	0.22	-0.09	-0.11	0.67	-0.28	0.52	1.00

Notes:

a) The correlation table is for the overall agri-food industry, so ProdAgri_pc, OFDIN_region in the table are the values of overall agri-food industry.

Table 5 Main results: conditional logit estimation results

Industry	Overall Agri-food	Sub Agri-food Industries				
		Planting	Livestock	Fishery	Agriprocess	Foodmanu
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural resource seeking						
Ln(AgriLand)	0.266***	0.304***	0.547***	0.114*	0.210***	0.229***
	(0.020)	(0.038)	(0.093)	(0.062)	(0.047)	(0.08)
ProdAgri_pc[a]	1.083***	1.778***	1.236***	3.069***	0.784***	1.633***
	(0.100)	(0.474)	(0.290)	(0.94)	(0.237)	(0.257)
Foreign market seeking						
Ln(GDP)	0.177***	0.072	-0.009	0.184**	0.260***	0.593***
	(0.024)	(0.048)	(0.122)	(0.073)	(0.056)	(0.093)
Pop_gr	0.076**	0.073	0.101	-0.058	0.117*	0.195**
	(0.032)	(0.060)	(0.155)	(0.101)	(0.062)	(0.091)
FoodSupply_pc	-0.09	0.154	0.175	0.670**	-0.293	-1.108***
	(0.108)	(0.232)	(0.578)	(0.284)	(0.244)	(0.378)
Control variables						
OFDIN_region[a]	0.298***	1.284***	2.134	2.790***	0.968***	0.768***
	(0.017)	(0.120)	(1.767)	(0.632)	(0.218)	(0.162)
Ln(Distance)	-0.832***	-1.134***	-0.847***	0.126	-0.904***	-0.858***
	(0.045)	(0.098)	(0.219)	(0.163)	(0.109)	(0.187)
RCNY	0.004	-0.028***	0.013	0.026***	0.038***	0.035**
	(0.003)	(0.007)	(0.026)	(0.010)	(0.008)	(0.014)
EFI	-0.042***	-0.080***	0.029	0.001	0.005	0.017
	(0.005)	(0.008)	(0.027)	(0.014)	(0.013)	(0.018)
IFDI/GDP	0.882*	-0.987	-0.49	3.303***	0.472	1.94
	(0.518)	(1.186)	(2.393)	(1.197)	(1.307)	(2.809)
PoliStability	0.112**	0.322***	0.321	-0.077	0.169	-0.091
	(0.047)	(0.088)	(0.271)	(0.137)	(0.117)	(0.193)
InternetUse	-0.002	0.005	-0.003	-0.019***	-0.0010*	-0.004
	(0.002)	(0.004)	(0.013)	(0.006)	(0.005)	(0.009)
No. of firms	1587	454	69	185	280	161
No. of choices	104	104	104	104	104	104
Observations	152763	44026	7080	17116	27565	14896
Pseudo R^2	0.135	0.187	0.254	0.069	0.150	0.281
$LR\ \chi^2$	1857.310	742.170	162.060	106.970	372.340	377.780
Prob > chi^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: Standard errors are presented in parentheses. *, **, *** denote significance at the 0.1, 0.05, and 0.01 level, respectively.

a) ProdAgri_pc and OFDIN_region use different data in each column (industry). See details in Table 3-Summary statistic.

Table 6 Robustness check: random effect negative binomial estimation results

Industry	Overall Agri-food	Sub Agri-food Industries				
		Planting	Livestock	Fishery	Agriprocess	Foodmanu
	(1)	(2)	(3)	(4)	(5)	(6)
Agricultural resource seeking						
Ln(AgriLand)	0.301***	0.687***	0.498***	0.094	0.397***	0.193
	(0.073)	(0.176)	(0.171)	(0.132)	(0.111)	(0.119)
ProdAgri_pc	0.927**	2.489*	1.791**	3.362*	0.681	1.997***
	(0.381)	(1.347)	(0.827)	(1.786)	(0.465)	(0.515)
Foreign market seeking						
Ln(GDP)	0.157*	-0.0884	0.001	0.217	0.231**	0.643***
	(0.081)	(0.182)	(0.200)	(0.170)	(0.111)	(0.141)
Pop_gr	0.111**	0.0473	0.071	0.0604	0.174**	0.211**
	(0.052)	(0.132)	(0.213)	(0.151)	(0.078)	(0.096)
FoodSupply_pc	-0.295	-1.503**	0.497	0.723	-0.275	-1.131**
	(0.309)	(0.612)	(0.882)	(0.623)	(0.422)	(0.548)
Control variables						
OFDIN_region	0.032	-0.275	2.085	-1.199	0.162	0.501**
	(0.042)	(0.276)	(2.302)	(1.238)	(0.350)	(0.221)
Ln(Distance)	-1.152***	-2.125***	-1.458***	-0.523	-1.647***	-1.137***
	(0.200)	(0.452)	(0.469)	(0.373)	(0.296)	(0.295)
RCNY	-0.003	0.050	-0.021	0.029	0.009	0.017
	(0.014)	(0.038)	(0.050)	(0.030)	(0.019)	(0.023)
EFI	-0.013	-0.011	-0.0002	-0.005	-0.004	0.001
	(0.012)	(0.020)	(0.035)	(0.025)	(0.019)	(0.024)
IFDI/GDP	0.959	-0.061	0.337	4.791**	0.959	2.185
	(0.914)	(1.999)	(2.528)	(1.972)	(1.797)	(2.917)
PoliStability	0.265**	0.202	0.606	0.0199	0.506***	0.049
	(0.112)	(0.208)	(0.372)	(0.271)	(0.192)	(0.229)
InternetUse	-0.007	0.022**	-0.018	-0.018	-0.013	-0.012
	(0.005)	(0.009)	(0.016)	(0.011)	(0.008)	(0.011)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	1044	1044	1044	1044	1044	1044
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000

Notes:

Standard errors are presented in parentheses. *, **, *** denote significance at the 0.1, 0.05, and 0.01 level, respectively. Dependent variables are numbers of Chinese newly established foreign affiliates in the agri-food sector of host countries. In column (1), the dependent variable includes affiliates in the whole agri-food sector. In column (2)-(6), the dependent variables include affiliate numbers in each sub agri-food industries.

Figures

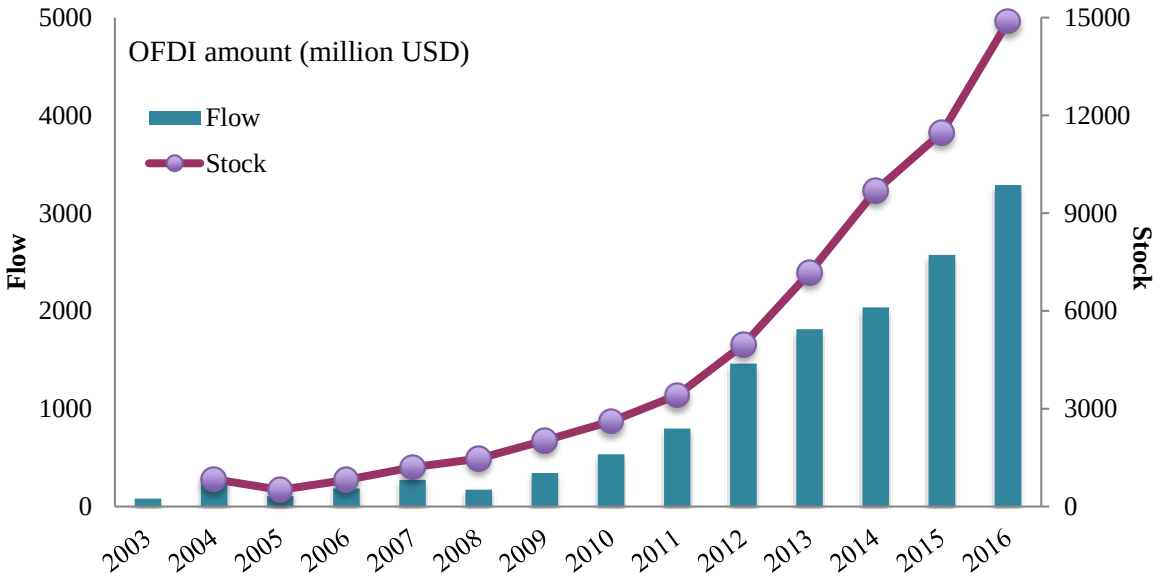
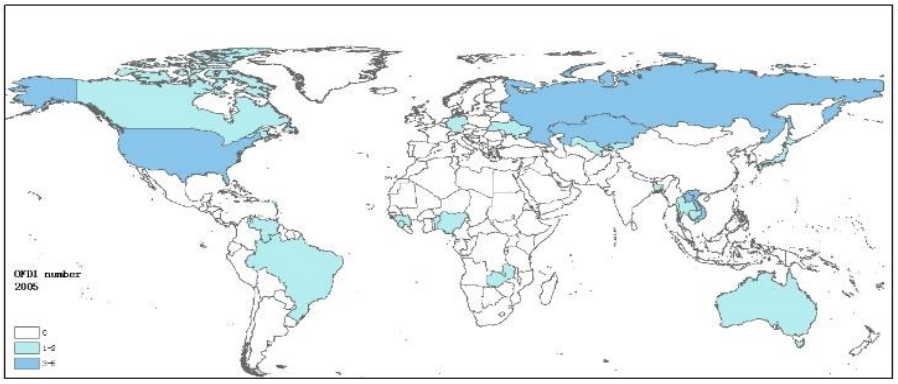
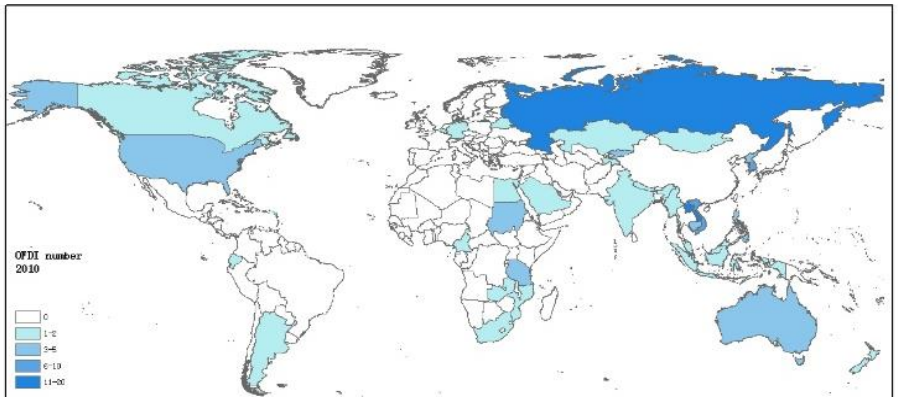


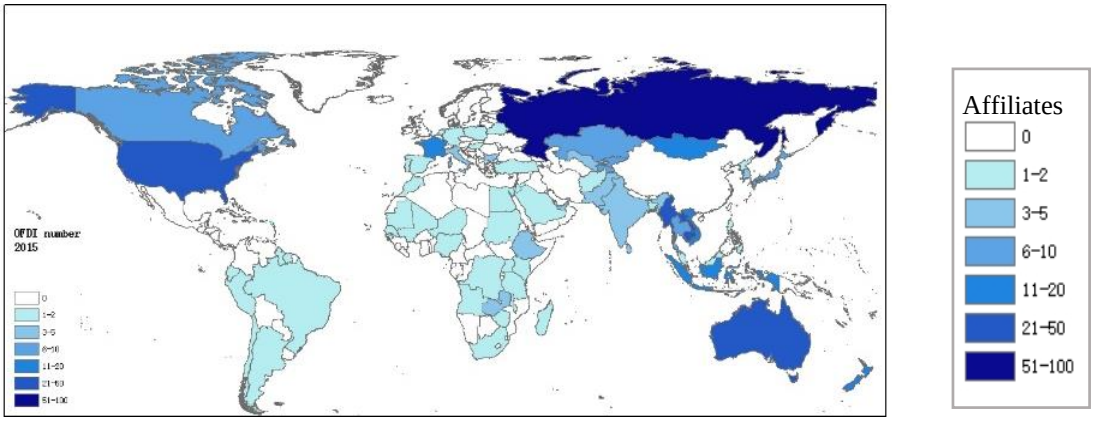
Fig. 1 Chinese OFDI amount in agriculture, forestry, livestock husbandry and fishery sector, 2003-2016.
Data Source: National Bureau of Statistics of the P. R. China (2004-2016).



a-2005



b-2010



c-2015

Fig. 2 Numbers of Chinese newly established agri-food affiliates around the world in 2005, 2010, 2015.
Data source: the authors' calculation based on data released by Ministry of Commerce, P. R. China

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