The Role of Foreign Direct Investment and Food Processing Industry toward High Value Agriculture in Asia - Cross Country Statistical Analysis and Farm Level Evidence -

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Abstract

In many Asian countries, agricultural industrialization led by agro-industries has been progressing, and agricultural production has been shifting from staple foods to high value commodities such as vegetables, fruits and livestock products. This trend is considered to have contributed to improving agricultural profitability as well as to expanding rural employment. The purpose of the paper is to test the hypothesis that the foreign direct investment (FDI) promotes high value agriculture through development of the food processing industry. We estimated factors that determine labor productivity in the food processing industry and agricultural sector, and obtained cross country statistical results that provide supports to the hypothesis. The typical case of this FDI-food industry-farm linkage is seen in contract farming, in which firms provide technical assistances and guaranteed markets to farmers. The results of a farm household survey implemented in China by the authors provide the farm level evidence to the linkage, in which foreign affiliated enterprises play important roles in technology transfer in compliance with food safety standards.

Introduction

The purpose of the paper is to test the hypotheses that the foreign direct investment (FDI) contributes to the development of the food processing industry [note 1)], and that the role of the food processing industry is significant in the process of realizing high value agriculture.

Many Asian countries achieved relatively high food self-sufficiency rates due to adoption of the Green Revolution after the 1970s[4]. However, there remains a huge amount of rural poverty in these countries. The reasons are declining prices of staple foods caused by overproduction and demand shrink, as well as limited labor absorption by the manufacturing sector[10].

Therefore, it is necessary to increase the profitability in the agricultural sector by promoting labor intensive high value agriculture. There are some ways to realize it. One is to promote the production of high value commodities such as vegetables, fruits and livestock products. Others are to enhance food processing and food quality / safety, for which multinational enterprises have comparative advantages in production technologies and management systems.

In Asian countries, agricultural production has been diversifying toward high value commodities, with the food processing industry as well as modern supermarket chains[5] led by foreign direct investment having developed in the last decade. Have these trends of agricultural industrialization contributed to increasing value added in the agricultural sector? This paper tries to answer this question through cross country statistical analyses and firm-farm

level survey.

Foreign direct investment and the labor productivity of the food processing industry

Production and export of processed foods are often managed by foreign affiliated enterprises in developing countries. Therefore, we can pose a hypothesis that there is a positive relation between FDI inflows and labor productivity in the food processing industry. If the hypothesis is supported, it implies that foreign investments do not fully crowd out local investments, and contribute to the development of the food industry in the host country.

The impacts of FDI on host countries are very complicated. If there is not a competing local industry in the host country, the emerging foreign enterprises will contribute to produce new goods or services, and to create new jobs. When there are existing local enterprises that are competing with the foreign ones, however, FDI is often criticized for sweeping out local ones, as is often seen in mom-and-pop stores driven out by foreign big supermarkets. Even if the criticism is correct, FDI would be supported again if the technologies and management practices accompanying to it could activate local enterprises as is referred to in "spillover effects."

Empirical arguments on the spillover effects are very controversial. A case study in Venezuela[1] reported that the benefits from foreign investment are internalized by joint ventures and that technology spillovers from foreign to domestic firms can not be found. Furthermore, a Turkish study[9] suggests that multinational corporations have a negative spillover effect on all industries, but it turns to positive with a lag period. A survey on Chinese manufacturing sectors[6] concludes that the technological spillover effects from foreign to subcontract firms are successful.

In order to find a relation of FDI with labor productivity for the case of the food processing industry, let us look at time series changes of these variables in Malaysia, Indonesia and India, for which continuous time series data are available (Fig. 1). Labor productivity in Malaysia and Indonesia increased sharply after 1992 and 1990 respectively, falling behind some years to the commencement of inflows of foreign capitals. They began to decrease due to the Asian economic crisis which took place in 1997, while it started to increase rapidly again in Indonesia. In India, it has been rising since 1993 due to the economic reform, whereas FDI inflow per employee in this sector is still very limited.

We estimate an equation that explains the labor productivity of the food processing industry by per capita GDP and the FDI inflow of the country. This is because the marginal productivity of labor of each industry equals
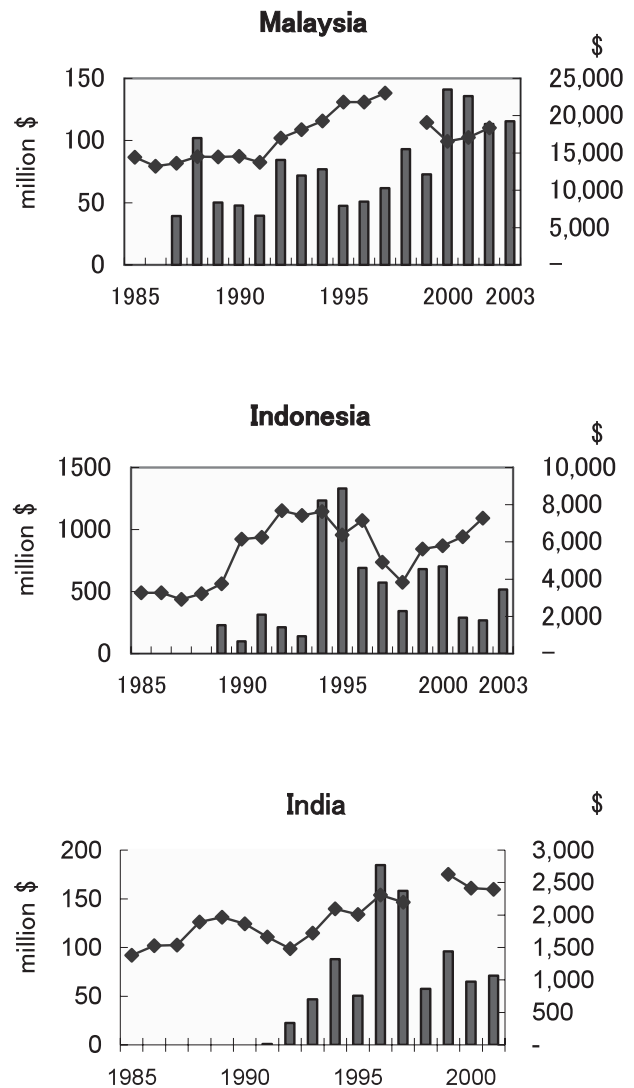

Fig. 1. FDI inflows and labor productivity changes in the food processing industry
FDI data: UNCTAD, JETRO.
Food industry data: UNIDO "INDSTAT2004", "International Yearbook of Industrial Statistics"
■ FDI (million $), ◆ Value added/employee ($)

to the social average wage rate which correlates strongly with the per capita GDP, if the labor market works perfectly and labor quality across industries is homogeneous. However, these conditions are not satisfied in fact. In developing countries, foreign enterprises and joint ventures have advanced technologies and management practices compared with local enterprises in general. Therefore, the relation of the labor productivity of the food processing industry (Y_f / L_f) with the per capita GDP and FDI inflow to the food processing industry (FDI_f) is presented as the following equations (1) and (2);

$$Y_f / L_f = A \cdot f (GDP) \tag{1}$$

$$A = g\,(FDI_f\,/\,L_f) \tag{2}$$

where A is a coefficient representing the efficiency of labor resulting from advanced technologies and training for labors, and FDI_f is the average in the previous five years [note 2)]. Then the equation to be estimated is presented as follows:

$$Y_f\,/\,L_f = f\,(GDP)\cdot g\,(FDI_f\,/\,L_f) \tag{3}$$

For the regression analysis, available cross country data set is pooled for the two periods; the year 1995–96 and 1999–2001. The estimated result (Table 1, Eq.1) presents that the labor productivity of the industry as determined not only by per capita GDP but also by FDI inflow to the host country, implying that the role of FDI is not limited to providing physical capitals but includes technology transfer. This statistical result is consistent with the case study for the Polish dairy sector[3] that presents a positive contribution of foreign companies to improve quality of products by local small suppliers both directly through firm-farm integration and indirectly through spillover effects.

Firm-farm value added linkage

Next, let us compare labor productivity in the food industry and agricultural sectors. Fig. 2 presents the value added in both sectors per agricultural worker in Asia for the two periods; the year 1995–96 and 1999–2001. There

Table 1. Estimated equations

Equation 1			Equation 2		
Dependent variable	$\ln(Y_f\,/\,L_f)$		Dependent variable	$\ln(Y_a\,/\,L_a)$	
Independent variables	Coefficient	(t-value)	Independent variables	Coefficient	(t-value)
Constant	1.346	(1.375)	Constant	3.754	(5.598)
$\ln(FDI_f\,/L_f)$	0.330	(3.274)	$\ln(Y_f\,/\,L_a)$	0.130	(2.013)
$\ln(GDP)$	0.785	(5.178)	$\ln(GDP)$	0.394	(3.421)
DMEX	−2.464	(−4.559)	$\ln(LAND/L_a)$	0.602	(5.519)
			IRR	0.005	(1.324)
			VFR	0.026	(2.136)
			DLA	−0.008	(−0.054)
			DAF	−0.077	(−0.586)
R^2	0.860		R^2	0.881	
Adjusted R^2	0.830		Adjusted R^2	0.868	
Sample size	18		Sample size	68	

$Y_f\,/\,L_f$: Value added per worker in food processing industry ($); UNIDO.
$Y_f\,/\,L_a$: Value added in food processing industry per agricultural worker ($); UNIDO, World Bank.
$Y_a\,/L_a$: Value added in agricultural sector per agricultural worker ($); World Bank.
$FDI_f\,/\,L_f$: FDI inflow per worker in food industry in the average of previous 5 years ($),
$\quad(\Sigma\,FDI_f/5)/L_f$; JETRO, UNCTAD, UNIDO.
GDP: Per Capita GDP ($); World Bank.
$LAND/L_a$: Size of arable and permanent crop land per agricultural worker (ha); FAO & World Bank.
IRR: Irrigation ratio (irrigated area / arable and permanent crop land (%)); FAO.
VFR: Vegetables & fruits area / arable and permanent crop land (%); FAO.
DMEX: Dummy variable for Mexico (=1 for Mexico, =0 for others).
DLA: Dummy variable for Latin America (=1 for Latin American countries, =0 for others).
DFA: Dummy variable for Africa (=1 for African countries, =0 for others).

Note 1) Values are deflated by 1995 GDP deflator.
Note 2) The data in Eq.1 covers Cambodia*, Indonesia, Malaysia, Thailand, India, Turkey*, Argentina,
$\quad$ Brazil*, Chile, Columbia, Mexico* (*: 1999–2001 data only).
Note 3) Mexican economy suffered by currency appreciation after joining NAFTA and by severe
$\quad$ competition with China in the US market.

is a positive correlation between Y_a / L_a and Y_f / L_a except for Jordan [note 3], where the subscripts a and f represent the agricultural and food processing sectors respectively.

To make clear this issue, regression analysis is applied to the available data set that includes not only Asia but also Latin America and African countries for the two periods; the year of 1995–96 and 1999–2001. Then the number of observations is 68, composed of 14 Asian, 12 Latin American and 13 African countries.

Similar to the equation (1), labor productivity in agriculture is presented as follows:

$$Y_a / L_a = B \cdot h(GDP) \qquad (4)$$

where B is a coefficient of efficiency of agricultural labor resulting from imperfect labor and land markets, difficulty in commodity shift to be produced, and heterogeneity of labor quality across industries. In addition, B is composed of C and D presented as follows:

$$B = C \cdot D \qquad (5)$$

where C is the extent of benefits given to a farmer by natural and social conditions within the agricultural sector, and D is the extent of benefits given to a farmer by the food processing industry such as the expansion of market size for farm products, absorption of abundant farm labor and technology transfer through contract farming.

Then the equation to be estimated is presented as follows:

$$Y_a / L_a = C (LAND/L_a, IRR, VFR) \cdot$$
$$D (VAF /L_a) \cdot h (GDP) \qquad (6)$$
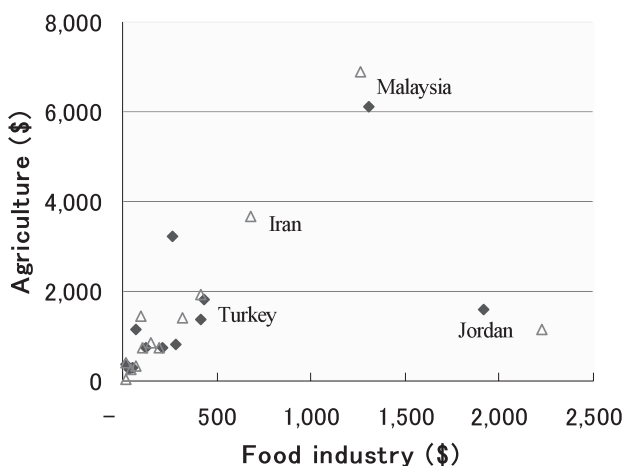
Fig. 2. Value added in the agricultural and food industry sectors per agricultural worker in Asia
Food industry data: **UNIDO**, "INDSTAT", "Industrial Statistics".
Agricultural data: **FAO**, "FAOSTAT", **World Bank**, WDI.
◆1995/96, △1999/01

where LAND is the farm land size, IRR is the irrigation ratio, VFR is vegetables & fruits land ratio, and VAF is value added in the food processing industry [note 4]. To test the difference in other natural conditions that can not be covered by the above variables in each continent, the equation has dummy variables in constant terms for Latin America and African countries.

The estimated result is presented in Table 1 Eq. 2, in which all independent variables other than continental dummies have positive signs and significant t-values. The coefficient of VAF /L_a is positive, indicating that the more the value added in the food processing industry is, the more the value added in the agricultural sector is, given the number of farm labor. This estimated result implies that the development of the food processing industry as well as agricultural diversification toward vegetables & fruits have contributed to realize high value agriculture through an increase in labor productivity.

The above analysis is limited to farm-food processor linkage, but vertical coordination between farmers and supermarkets is also becoming popular throughout the world due to a prevalence of food safety consciousness even in the developing countries, and foreign supermarkets are major players here too. Therefore the role of FDI is considered to have been increasing toward the development of vertical coordination and agricultural industrialization.

Farm level evidence on FDI-firm-farm linkage

In the previous sections, we found statistical evidence on FDI-firm-farm linkage. Can we find farm level evidence that supports the linkage? As addressed by Reardon et al., "Many of those transformations present great challenges for small farms, but also potentially great opportunities"[7], empirical farm evidence is very limited.

The Indian case study[2] presents a widespread difference in net income per unit weight product between contract and non-contract farmers. For example, milk and vegetable contract farmers gain more than non-contract farmers by 34% and 51% respectively. Various services including transportation and assured market provided by contract firms that are conceptualized as "transaction cost" are the main causes of the differences.

We implemented a farm household survey to collect income data in Shandong province, China, where comparison of income between non-contract farmers and that of contract farmers who contract with firms with different composition of foreign capital holding is possible. The survey was carried out in June-August in 2005, and the data as of 2004 for 162 farmers who produce shallot and apple were collected[8].

In addition to the farm household survey, we im-

plemented a basic survey for six firms that have contract farming schemes in the province on the criteria in selecting contract farmers and what services they are providing to the farmers, as well as a complementary survey on firms' spatial mobility of business activities in 2005 in Thailand and in 2007 in Shandong province, China for 8 firms respectively, in order to get an evidence of the sustainability of the contract farming scheme.

According to the farm household survey, the difference in labor and land productivity by farm category is very significant (Fig. 3), while there is not a significant difference in the productivity caused by age and education of household heads. Labor productivity and land productivity of apple by contract farmers with foreign firms are higher than those by non-contract farmers by approximately 60% in value terms. Similar to apple farmers, the productivities of shallot by contract farmers with a joint venture are higher than those of contract farmers with local firms and non-contract farmers by 24–83%.

Based on the basic firm survey, firms provide farmers with technical supports through course training and visiting assistances, and they procure more than 85% of the farm products complying with the standards on the basis of market price plus a certain margin or fixed contract price. In the case of apple, a firm provides farmers with imported low crop-residue-prone pesticide.

According to the complementary firm survey, moreover, we found the fact that all of the surveyed firms did not have plans to move their business locations to other countries, except a Thai firm which has a plan to move to the eastern region, in spite of wage rate hike in their countries. This implies that once firm-farm vertical coordination is established, the relation would not be vulnerable to the changes in market conditions.

Conclusion

In many Asian countries, agricultural industrialization led by agro-industries has been progressing, and agricultural production has been shifting from staple foods to high value commodities. Have these developments contributed to improve farm productivity and income?

In this paper, we obtained three evidences by cross country statistical analyses and firm-farm surveys regarding the agricultural industrialization. The results are; a) FDI has contributed to improve labor productivity in the food processing industry, b) the food processing industry has contributed to improve labor productivity in agricultural sector, and c) production shifts towards vegetables and fruits have contributed to improve labor productivity in the agricultural sector.

Production shifts toward high value commodities
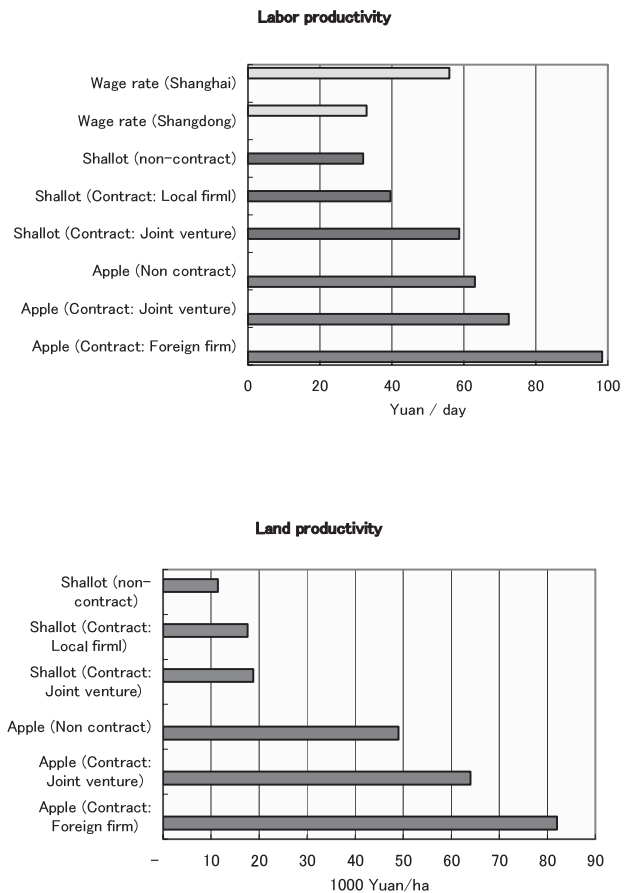
Fig. 3. Productivity by farm type in Shandong province, China

themselves contribute to enhance farm labor productivity, but there are obstacles for small farmers in developing countries to perform the tactics due to insufficient market access and technological diffusion for such commodities. These constraints can be removed by participation of agro-industries that link farming to retailing, and the role of foreign direct investment in the food industry is considered significant in accelerating the trend toward high value agriculture.

The issue remaining is whether any type of foreign firms in the food industry has a similar impact on agriculture. Does it depend on whether they are processors or retailers, whether they are export oriented or local market oriented, or whether they procure food materials from local suppliers or from importers? This issue is very crucial for policy making in attracting foreign capital, in which governments in developing countries have wide discretion.

Notes

1) The food industry belongs to both the manufacturing and service sectors, in which the food processing industry belongs to the manufacturing sector, while food

retailers and distributors belong to the service sector.

2) Management resources (MR) are transferred proportionally to FDI as presented MR= η FDI, then MR received per worker of the industry is presented as η FDI$_f$ / L$_f$.

3) Apparent irregular data for Jordan is explained satisfactorily by other variables in the regression analysis as the Equation 2 in the Table 1.

4) Benefits given to farmers from the food processing industry (BF) is presented as BF= ξ VAF, and then benefits given to a farmer is presented as ξ VAF / L$_a$.

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