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October 2010

Online at <http://mpra.ub.uni-muenchen.de/26499/>
MPRA Paper No. 26499, posted 08. November 2010 / 15:16

The Contracts between Leading Agribusiness Enterprises and Rural Households and Its Effects on Firm-level Export of Agricultural Products, Chao Peng et al.

The Contracts between Leading Agribusiness Enterprises and Rural Households: Its Effects on Firm-level Export of Agricultural Products

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(Received[--- blank ---]and accepted[--- blank ---])

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ABSTRACT

In this paper, transaction cost is introduced into the general firm-level export behavior model. By so doing, we build a theoretical model explaining how connection modes between leading agribusiness enterprises and rural households affect the firm-level agricultural products export. Analyzing the dataset of 561 national leading agribusinesses of the year 2003, we use Tobit model to estimate the firm-level export effect of the connection modes. The empirical result demonstrates that connections in the mode of stock-cooperation or cooperation contracts have a significant positive effect on the enterprises export and export ratio. In addition, the connection with more characteristics of factor contract has stronger effect on export than that with commodity contract characteristics.

INTRODUCTION

The development of leading agricultural enterprises is an important factor in solving the conflicts of “small household” and

“large market” in China.ⁱ In recent years, the Leading Agribusiness Enterprises (LAEs) greatly promoted the industrialized organization and strengthened the connection between farmers and enterprises. About 45% of the agricultural industrialized organizations are activated by LAEs.ⁱⁱ In 2003, more than 52.7 million agricultural households have been attached to LAEs.ⁱⁱⁱ On the other aspects, the role LAEs plays in agricultural products exports is important too. National-level LAEs exporting profits reached \$6,661,000,000 which amount 31.36% of the total export profits of agricultural products.^{iv} Therefore, we can say that it is LAEs that link the scattered small household with the comprehensive international market.

Though the importance of contracting methods between LAEs and farmers is unquestionable, current research mainly focus on the evolution of contracting methods between LAEs and agricultural household (Zhou & Cao, 2001), descriptive research about the industrialized development of agriculture. Even though there are researches about the relationship between LAE and rural households,

their attention has been attached to “Agricultural Contracts”.

According to the data of national-level LAE, the average exporting rate of the enterprises which cooperate with the farms in the way of commercial contracting is only 21.4%, while the exporting rate of the enterprises which cooperated with farms in the ways of cooperation of joint cooperation reached 26.1%.The other ways of cooperation have a much lower exporting rate of 8.9%.^v

Therefore, by taking both the ways of LAE cooperating with farms and its export, we aim to analyze which kind of effect the ways of LAE-farm cooperation impose on agricultural export and vice verse. This research can not only further our understanding of the organization patterns of Chinese agricultural industrialization, but can also can give us implications to improve current agricultural industrializing patterns.

THEORETICAL MODEL

How to introduce the contracting patterns between LAE and farms into enterprise exporting behavior model

The linkage between farmers and leading processors is an essential procedure before the production. The Modes can be defined as two types, factor bond and commodity bond (Zhou & Cao, 2002). If transaction cost in the market is lower than inner transaction cost, a firm may adopt factor bond with farmers. Before production, transaction cost may come from negotiation about contract, enforcement, and cost from agents (1996). The vertical integration will help firms to reduce two kinds of transaction cost: i) seeking cost, ii) risks from low quality (Barkema & Cook, 1993). When test cost is too high and can not reflect the quality. It will lower market price. In all, vertical integration will reduce transaction cost (Hennessy, 1996).^{vi} By so doing, the price can go down to compete with other firms (Economides, 1999).

Enterprise exports are affected by factors like techniques, scale, input etc. A lot of studies on these factors have been conducted, most of which took an in-depth investigation on the level of enterprises (Schlegelmilch and Crook, 1988; Kumar and Siddharthan, 1994; Bernard and Jensen, 2001) with their focuses on building empirical

model to estimate whether the enterprise export or their export quantities, but few has strict model frame. The model deduction done by Aitken, Hanson and Harrison (1997) is comparatively strict, they claims that the market selection of enterprises of great representativeness can be described as selling products in different markets with the maximized profits:

$$\begin{aligned} & \text{Max}_{q_d, q_f} p_d q_d + p_f q_f - h(q_d + q_f) - m_d(q_d) - m_f(q_f) \\ & \text{s.t. } q_d, q_f \geq 0 \end{aligned}$$

(1)

Among which p, q respectively stands for price and sales quantity, d, f domestic market and international market, h, the production cost, m the cost of commodity circulation. However, instead of discussing export or export rate, they only investigated with whether export as the induced variable. Barrios, Görg and Strobl (2003) expand their study to export rate and considered difference of product market.

The connection between farms and LAE is the stage before production and can be divided according to the types of

contract—factor contract and commodity contract (Zhou & Cao, 2002).

Because market transaction cost is higher than management cost (internal trade cost), the enterprise adopted the way of factor contract.

Since transaction cost mainly arises from contract drafting, negotiation, supervised execution etc., it is closely related to agency cost

(Williamson, 1996). Barkema and Cook (1993) proposed in their

research of pork market vertical integration to reduce these two kinds

of costs through vertical integration: (1) seeking cost;(2) risk cost of

acquiring low quality raw materials. When the test cost is outrageous

and can not fully reflect the quality of commodity, the test result will

affect market price. Vertical integration can probably reduce this

transaction fee (Hennessy, 1996) .Then the price will be lowered and

market shares increase.

At present little attention has been paid to the export of enterprises,

if it had any, they did not analyze the effect of the cooperation pattern

between upper and lower producers at the pre-production stage on

enterprise export. In fact, to neglect this point is to neglect the effect

of raw materials. Studies on contract and transaction cost brought a new idea to the solution of this problem, that is the contracting pattern not only lead to the difference of transaction costs, but also influence enterprise export. In this paper will try to find out the effects of different transaction cost on enterprise export.

Introduction of transaction cost and modification of enterprise export model

In the model built by Aitken, Hanson and Harrison (1997), production cost and selling circulation cost are all simple quadrics and only the circulation cost difference of exporting products and domestic-sold products are taken into consideration, but the effect of technical standard and inspection & quarantine standards difference on production cost are neglected.^{vii} As we stated above, the enterprise may have to deal all kinds of transaction costs when acquiring raw materials and the transaction costs varied with contracting patterns. Williamson (1996) believed that only through comparing systems, that

is to compare one contract with another one, can their own transaction cost be estimated. In this sense, we only need to compare the transaction cost of all kinds of contracts.

Therefore, we the following assumptions:

- i) Agricultural enterprises face competitive market;^{viii}
- ii) Transaction costs of enterprise-farm cooperation relating to contracting patterns can be separated, that is only one part of the transaction cost are relevant to enterprise-rural household cooperation patterns.
- iii) Every enterprise should adopt one pattern to cooperate with rural household;
- iv) In the interval where the production is positive, transaction cost increase with production.
- v) All cost forms are simple quadrics (Aitken etc., 1997; Barrios etc., 2003).

Under these premises, we recount the cost of agricultural products as following form:

$$C(q_d, q_f) = h_d(q_d) + h_f(q_f) + T(q_d + q_f) + m_d(q_d) + m_f(q_f) + F \quad (2)$$

Among which, F is the fixed cost.

While the production cost and circulation cost can be expressed as,

$$h_l(q_l) = \frac{a_l}{2} q_l^2 + g_l q_l \quad (3)$$

$$m_l = \frac{b_l}{2} q_l^2 + c_l q_l \quad (4)$$

Among which, $a_l > 0$ and $b_l > 0$, $l = d$ or f . Different from the model proposed by Aitken etc., we believe that exporting products and domestic-sold products are different in production cost, a_l and g_l are correlated with the techniques of the enterprise and other factors that may cause cost difference; a lot of meanings were attached to b_l and c_l , whether the products are exported or sold domestically, they are affected by all kinds of factors such as the product certification, the enterprise credit grade etc., which lead to their cost difference. Meanwhile, the organization system can also influence the export in certain degree.

Transaction cost (associated with enterprise-rural household

cooperation) function is as follow:

$$T(q_d + q_f) = \frac{t}{2}(q_d + q_f)^2 + \frac{t'}{2}(q_d + q_f) \quad (5)$$

Among which, t and t' can be written as:

$$t = \sum_{k=1}^K 1(k=x)t_k, \quad t' = t_o + \sum_{k=1}^K 1(k=x)t'_k \quad (6)$$

Among which, $t > 0$ and $t' > 0$, they only relates to cooperation pattern, k is the kth contracts, K is the number of the contract patterns, x means the enterprise adopt the xth contract, t_k and t'_k are transaction cost indexes with relative meaning and only related to contract patterns. t_o is the other measures of factors concerning supervision, for example, the enterprise motivation mechanism and transaction-related service. Knoeber and Thurman (1995) noticed in their study of the industrialization of roasted chicken that the manufacturing company supplied chicken, feedstuff and offer veterinary service to producers, and the producers supply capital in the form of labor force and chicken farm. Because chicken-raising need a large-scale sunk investment, they believed that the processors give the incentive investment willingness a

credible signal which induced the self-selection of high quality producer to solve the problem of adverse selection, this kind of signal does not exist in vertical integration.

So, the profit maximization aim of typical agricultural products enterprises become:

$$\begin{aligned} \text{Max}_{q_d, q_f} \pi &= p_d q_d + p_f q_f - h_d(q_d) - h_f(q_f) - T(q_d + q_f) - m_d(q_d) - m_f(q_f) - F \\ \text{s.t. } q_d, q_f &\geq 0 \end{aligned} \quad (7)$$

The hypotheses of export sales export proportion

Put formulas (3), (4), (5) into formula (7) and get the maximization condition, we can get the export sales which maximizes the profits as follow:

$$EX = p_f q_f = \frac{p_f}{a_f + t + b_f} (p_f - g_f - t q_d - t' - c_f) \quad (9)$$

It is obvious that if there was the mth and nth ways of

household-enterprise contracting, since $t_m > t_n$, $t'_m > t'_n$, then we get

$EX(m) < EX(n)$. That indicates that enterprises adopting contracting

ways of lower cost export more.

Since the export and input are negative associated with each other

and affected by the scale, we eliminate this through investigating

export:

$$ER = \frac{\frac{P_f}{a_f + t + b_f}(p_f - g_f - tq_d - t' - c_f)}{\frac{P_f}{a_f + t + b_f}(p_f - g_f - tq_d - t' - c_f) + \frac{P_d}{a_d + t + b_d}(p_d - g_d - tq_f - t' - c_d)} \quad (10)$$

According to formula (9), the effects of different exchanges cost on export rate are complicated. It is possible that even if enterprise adopting low exchange cost contract have large export quantity, a large domestic sales growth which leads its export rate lower than that of enterprises adopting contract of higher costs. The direction which is affected by enterprise export rate may not be certain, but we have to point out that it is the current situation that China's high-quality agricultural products are mainly exported to foreign countries. The costs of supplying high quality agriculture product to enterprises are comparatively higher, and generally speaking, $p_f > p_d$, thus the export rate is possibly increase with the contract-caused exchange cost decrease

On the basis of the above analysis, we propose the following

hypothesis:

Enterprises tend to export the products, when the exchange cost of contract is low.

DATA SOURCE

The data we used are all from the 2003 audit materials of 582 national-level LAEs collected by agricultural industrialization office of Agricultural Department. Because the materials of 21 LAEs are incomplete, we only have 561 validate samples. The audit materials include basic data of the total investment, real estate, assets liability ratio, total sales, domestic sales, exports, credit grade, ownership etc., data which demonstrate product characteristics like main product types, enterprise certification, even data that illustrate LAE-rural household cooperation patterns such as whether enterprises supply services to the rural households, whether they purchase agricultural products at protection price, patterns with which the LAEs promote rural households. Since there are serious standards for LAE and all of them

are selected with strict audition, we believe the samples used in this paper represent the most important part of LAE in China.^x

As is shown in Table 1, the average total assets is 736.8 million RMB, average fixed assets is as high as 277.4 million RMB, average liability/asset ratio is 46.9%, average profit is 33.8 million RMB with an average profit rate as 7.1%.

Table 1 Description of Leading Enterprises

From the perspective of industry structure, 45.3% of the enterprises are engaged in crops processing or productions with crops as the raw materials; and about 32.8% of the enterprises take livestock breeding products as raw materials. Enterprises (because its raw material can be products of either planting industry or livestock breeding industry, so it is considered separately) producing oil or grease is of 8.0%. And enterprises of other industry are of 21.4%.^{xi}

See from the enterprise ownerships, more than 50% of them are limited liability companies with unclear ownership, following are the

32.3% of mixed ownership with shareholders system; in addition, there are 7.7% state-owned enterprises, 2.5% collectively-owned enterprise, 2.5% joint ventures of Hongkong, Mocado and Taiwan, 2.1% overseas-funded enterprises, 2.0% enterprises and sino-foreign joint ventures with a small portion of 0.4%.

See from the leading enterprise-rural household connecting modes, contracting mode takes the largest portion of 85.0%, cooperation or share system mode take 8.9% and 6.1% enterprises are of the other modes. Besides, 61.7% of the leading enterprises have exporting business. In accordance with our study objective, we connect these two factors together and get Table 2. It is found that the export amount and export rate vary with enterprises with different connecting modes. Enterprises adopting cooperative or shareholding cooperative mode have the largest export amount and the highest exporting rate and enterprise adopting connecting modes other than cooperation mode and contract mode has the smallest exporting amount and the lowest exporting rate.^{xii} Therefore, we can conclude that there is certain

relation between LAEs export and their modes connecting rural households.

Table 2 The LAEs' Export and Their Modes Connecting Rural Households

METHODOLOGY

For the sake of estimation, we write (9) and (10) into the following liner pattern, namely the export amount of enterprise i is as follow:

$$EX_i = \alpha_1 p_{f,i} + \alpha_2 q_{d,i} + \eta t_i + \delta W_i + \beta V_i + \gamma D_i + u_{f,i}$$

(11)

Among which, t_i is relative transaction cost, W_i is the portion of the transaction cost unaffected by agricultural availability. Vector V_i is production cost including the effect of production input on cost. Vector represents all kinds of cost of transaction and marketing, including manufacturing cost. As it is stated in the previous part, scale factor might affect the exporting amount of the enterprises, so we have to estimate the exporting rate equitation.

The exporting rate of enterprise i is as follow:

$$ER_i = \alpha_{R1}p_{f,i} + \alpha_{R2}q_{d,i} + \alpha_{R3}p_{d,i} + \eta_{Rt}t_i + \delta_R W_i + \beta_R V_i + \gamma_R D_{ii} + u_{R,i} \quad (12)$$

Considering that there are large amount of enterprises have no exporting business, we adopt Tobit model to avoid the effect of 0 values on the result. Moreover, because exporting price and exporting amount data are not available, we choose not to introduce them into this model. So, based on the previous analysis and the empirical model design standard, we adjust formula (11) and (12) accordingly as follow:

$$EX_i^* = \eta_1 coo_i + \eta_2 con_i + \delta_1 far_i + \delta_2 far_i^2 + \delta_3 ser_i + \delta_4 pro_i + \beta_1 avc_i + \beta_2 avc_i^2 + \beta_3 hit_i + \beta_4 IND_i + \gamma_1 cre_i + \gamma_2 iso_i + \gamma_3 INS_i + u_{f,i}, u_{f,i} | x \sim \text{Normal}(0, \sigma^2)$$

$$EX_i = \max(0, EX_i^*)$$

(13)

$$ER_i^* = \eta_{R1} coo_i + \eta_{R2} con_i + \delta_{R1} far_i + \delta_{R2} far_i^2 + \delta_{R3} ser_i + \delta_{R4} pro_i + \beta_{R1} avc_i + \beta_{R2} avc_i^2 + \beta_{R3} hit_i + \beta_{R4} IND_i + \gamma_{R1} cre_i + \gamma_{R2} iso_i + \gamma_{R3} INS_i + u_{f,i}, u_{Rf,i} | x \sim \text{Normal}(0, \sigma^2)$$

$$ER_i = \max(0, ER_i^*)$$

(14)

In the above model, x represents all the independent variables, while IND is a group of dummy variables that represent the industries an enterprise engaged in and INS is a group of dummy variables of

enterprise system, β_i and γ_S are the corresponding index.

According to the above empirical model, we list all the variables and description data in Table 3

Table 3 Descriptive Statistics for Dependent Variables and Independent Variables

To verify the hypothesis, we focus on the indices η_1 and η_2 of coop and con. If both η_1 and η_2 are greater than zero, we can conclude that the exporting amount of enterprise adopting contracting or cooperation modes is larger than that of the enterprises adopting other contracting modes. Namely the hypothesis is verified. Of course, the values of η_1 and η_2 are also a question we are interested in.

EMPIRICAL RESULT

A line of Table 4 reports the estimation result of exporting amount equation, equation (13); while line B reports the estimation result of exporting rate equation, equation (14), in which effects of scale are eliminated.

Tobit model estimation pursues the maximization of logarithm likelihood value. The logarithm likelihood value -3523.19 of exporting amount equation is obviously greater than that of exporting rate equation with a value of -417.19.

Table 4 Estimation for Export Rate and Export

The Implication of Contract Modes on Export

As it was shown in the empirical results, the hypothesis was tested. The firms connected with farmers through contract export more. This trend remains after we get rid of the scale effects. The coefficient of cooperative mode or share-holding cooperative mode is 0.34 and significant at 5% level. Both the coefficients and significant levels of cooperative mode are more than those of contract mode. In another word, for export, cooperative mode works better than contract mode.

Cooperative mode offers a kind of factor bond from firm to farmers. This kind of bond is lower in transaction cost. In the specification of model, we found that the firms connected with farmers through contract mode export more. Factor bond will work better for connecting firms

and farmers. To begin with, firms will control stricter on quality. And quality control is easier to be realized. Moreover, an enterprise will gain a stable material source after cooperate with farmers through share-holding, collective or cooperatives. Under cooperative mode, farmers usually share profit with firms. Farmers become the workers in firms or share holders in some sense. Even somebody plays both roles. By so doing, rural households who produce for enterprises would like to bound themselves to processors. In some sense, they are in the common. And this result in lower transaction cost of firms. This kind of saving is from negotiation before production, management in production, trade after production, enforcement and so on.

We have discussed above, contract mode has its own advantage. But firms need to establish some ties to prevent farmers from opportunism behavior to gain this kind of advantage. If the prices of agricultural products do not raise a lot, rural households will not default. However, if the prices of agricultural products raise a lot and are much higher than the contract prices before production, rural

households may not enforce the contract. A small-scale farmer will take little risk and cost to break a contract. So the punishment from breaking a contract will not make a rural household to enforce a contract (Guo, 2006).

As a comparison, other connection modes may decrease the transaction cost of firms. If a firm procure material through market, it may face difficulties such as: i) difficulties to monitor the quality; ii) a kind of special transaction cost, seeking cost, including seeking for material source, seeking for qualified agricultural products; even iii) cost from bargaining for prices.

Implication of other transaction cost

The numbers of farmers who have trade connection with firm have positive effects with firm export. But this number is lower in significant level when export rate is taken as dependent variable. So this independent variable is significantly related with scale. After getting rid of scale effect, the significant level is lower than before. It seems that service offered to farmers will help firms to export. But the

t-test is not significant. It is hard to measure how good the service is. If firms offer farmers seed, fertilizer, pesticide and food safety guidance which meet export standard, it will be good for export. The protective price is negatively correlated with the export of firms. The significant level decreases after we get rid of scale effect. The reasons may be: exerting protective price will make cost of firm increase. It may set a lowest price for a firm, the firm will not buy agricultural material and will reduce its export.

Other determinants of export

The technology level of a firm is negatively correlated with its export. It reflects the export situation of Chinese agricultural export. The agricultural products exported are mainly primary agricultural products. This is usually the aim of firms engage in agricultural development. As the improving of technology, export of firm will increase. So the t-test is not significant. The credit level has no significant effect on export. It really matters for export to pass ISO9000 certification. Because the certification may help products

overcome trade barriers. Firm institution and industry will also affect export.

CONCLUSION

The connecting mode of leading agribusiness and rural household has a significant impact on the connection between China's small rural household and international market. From the perspective of transaction cost, we analyze different effects and effects mechanism of different connecting modes through investigating the effect of connecting modes between national level leading agribusiness and rural household imposed on their export amount and export inclination

Results of theoretical and empirical study indicate that connecting mode with more potent contracting features is beneficial to export, connecting modes with more characteristics of commercial contract also has positive effect on export though its effect is not as significant as that of factor contracting mode. Besides, other connecting modes including external market have little promotion effect on export.

After eliminating scale factor effect, the effect of connecting mode

on LAE' export is more significant. LAE adopting shareholder system or cooperation system connecting rural household has more inclination to export and LAE adopting contract mode also has this inclination though it is not as strong as that of LAE of previous types.

Table 1 Description of Leading Enterprises

	Mean	Standard Error	Min	Max
Total Assets (million RMB)	736.8	2303.7	11.6	45908.3
Fixed Assets (million RMB)	277.4	749.9	7.07	15551.7
Liability/Asset Ratio (%)	46.9	14.7	1	97.9
Profit (million RMB)	33.8	79.2	-2.8	975.0
Profit Margin (%)	7.1	8.7	-18.2	91.5

Table 2 The LAEs' Export and Their Modes Connecting Rural

Households

LAEs' Connecting Rural Households	Modes	(Share Holding) Cooperative		Contract		Others	
		Mean	SD	Mean	SD	Mean	SD
Export (million USD)		16.3	35.1	11.8	42.0	7.2	15.5
Export Rate (%)		26.1	68.9	21.7	36.6	9.0	19.3

Note: S. E. refers Standard Deviation.

Table 3 Descriptive Statistics for Dependent Variables and

Independent Variables

Symbol	Dependent Variable	Note	Mean	SD
EX	Export	Export (Ten Thousand USDs)	1187.4	4025.6
ER	Export Rate	$(\text{Export} \times 8.277) / \text{Sales}$	0.215	0.400
	Independent Variables	Note		
t	modes connecting rural households			
coo	(share-holding) cooperative	Dummy Variable	0.089	0.285
con	contract	Dummy Variable	0.850	0.357
W	other transaction cost			
far	number of connected farmers		9390.4	2731.23
ser	offer services to farmers	Dummy Variable	0.975	0.156
pro	exerting protective price	Dummy Variable	0.938	0.242

avc	variable cost	Million RMB	4.043	15.2
hit	high-tech enterprise	Dummy Variable	0.444	0.497
IND	product type			
IND ₁	planting products	Dummy Variable	0.453	0.498
IND ₂	livestock products	Dummy Variable	0.328	0.470
IND ₃	edible oil	Dummy Variable	0.080	0.272
D	other factors may affect export			
cre	credit rating	A=1; AA=2; AAA=3;	2.367	0.677
iso	passed ISO9000	Dummy Variable	0.857	0.350
INS	firm institution			
INS ₁	Hong Kong, Macao, Taiwan	Dummy Variable	0.025	0.156
INS ₂	Joint Advanture	Dummy Variable	0.004	0.060
INS ₃	exclusively foreign-owned	Dummy Variable	0.021	0.145
INS ₄	State Owned Enterprise	Dummy Variable	0.077	0.266
INS ₅	collective owned	Dummy Variable	0.025	0.156
INS ₆	private owned	Dummy Variable	0.020	0.139
INS ₇	mixed owned	Dummy Variable	0.301	0.459

Table 4 Estimation for Export Rate and Export

	A	B		A	B
t			D		
coo	2471.53*	0.34**	cre	97.15	0.034
	(1358.90)	(0.14)		(358.41)	(0.038)
con	1634.68	0.23**	iso	1082.49	0.22**
	(1131.38)	(0.12)		(746.57)	*
					(0.078)
W			INS		
Log(far	462.38***	0.031*	INS ₁	2803.64**	0.34**
)	(166.08)	(0.017)		(1423.87)	(0.15)
ser	1449.63	0.12	INS ₂	2783.56	0.45
	(1673.162)	(0.17)		(3628.85)	(0.38)
pro	-2178.15*	-0.20*	INS ₃	1241.47	0.23
	*	(0.11)		(1556.89)	(0.16)
	(1083.17)				
V			INS ₄	2147.82***	-.067
				(926.78)	(0.099)
Log(vc)	943.95 ***	-0.0001	INS ₅	-2878.64	-0.33*
	(206.44)	9		(1635.43)	(0.17)
		(0.022)			
hit	-205.97	-.085*	INS ₆	1585.81	0.34*
	(493.13)	(0.052)		(1718.93)	(0.18)
IND			INS ₇	-774.05	0.068

				(566.30)	(0.059)
IND ₁	169.67	-0.011	Constant	-20686.59**	-0.58
	(517.58)	(0.054)		*	(0.38)
				(3610.90)	
IND ₂	-202.82	-0.	Log	-3523.19	-417.19
	(561.51)	114**	Likelihood		
		(0.059)	d		
IND ₃	-469.63	-0.28**	R square	0.1033	0.0661
	(918.88)	*			
		(0.099)			

Note: The standard errors are in the parenthesis. *, ** and *** refers to significant at the level of 0.1, 0.05 and 0.01. Specifically, the R square here is the square for correlated efficient between real value and estimated value of independent variable.

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ⁱ Document No 1 of 2007, the guideline of Chinese agricultural policies, evaluated leading processors as “an important force to lead farmers to develop modern agriculture”.

ⁱⁱ Niu, 2006.

ⁱⁱⁱ The source of export data is from Monthly Statistics of Ex & Import of Agricultural Products published by Ministry of Commerce.

^{iv} The source of data is the same with note 2.

^v The source of data is from Agriculture Industrialization Office of Ministry of Agriculture.

^{vi} Vertical integration is equal to linkage through factor bonds.

^{vii} Quality control can be considered as a pressure of processing. It will make the production slow, even stop. So the cost comes out (Klein & Brester, 1997). The production of two different commodities with different quality control can be considered as two productions. Perrin (1999) used to consider beef and beef with ray exposure as two different productions.

^{viii} Zeng & Peng (2007) offered some details about this premise.

^{ix} According to Aitken *et. al* (1997) and Barrios *et. al* (2003), $b_f = b_d$. It refers to the equality of marginal revenue. But in our paper, we divided the export and home sale market as two different markets. So $b_f \neq b_d$.

^x National leading processors should meet a lot criterion, such as firm's organizations, assets, financial situation, connection to farmers and competence.

^{xi} Some firms engage in not only one industry.

^{xii} Other mode mainly refers to procurement in market.