

FACTORS AFFECTING THE LINKAGE RISK IN PRODUCING AND CONSUMING RICE BETWEEN FARMERS AND ENTERPRISES IN THE LARGE FIELD MODEL AT CAN THO CITY

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ABSTRACT

The rice production-consumption linkage contract is becoming a major factor in promoting the development of agriculture in Can Tho City. The study used quota sampling to interview 215 farmers who participated in the large field model in Can Tho City. The Poisson regression analysis method is applied; the research results showed that six factors affect the linkage in producing and consuming rice between farmers and enterprises. The impact level of factors follows the order as Price difference; Penalty application; Technical support; Terms of Payment; Number of years participating in the linkage, and Input support.

Keywords: Linkage risk, Producing - consuming, Large field, Farmer, Enterprise

1. PROBLEM STATEMENT

Linkage in agricultural production is expected to help parties coordinate smoothly from the input supply stage to the consumption of output products. Secondly, it helps avoid and overcome adverse conditions of nature. Thirdly, it increases the competitiveness of products on the market and stabilizes the production process to prevent price pressure. However, canceling sales contracts and contending in selling and purchasing are common. The main reasons may come from both farmers and enterprises. This derives from the benefits of contractual consumption and the trend of shifting from spot trading to contractual trading increasing around the world (Minot, 1986; McDonald, 2004). Contractual production is an agreement between farmers and enterprises in which farmers supply agricultural products based on a delivery agreement at a predetermined price in the future (Eaton and Shepherd, 2001). According to Sykuta and Parcell (2003), contractual manufacture in agriculture provides rules for product transactions through three main allocated elements: benefits, risks, and decision-making power. This means that the agreed price must ensure that the seller gains certain benefits and the buyer purchases goods at an acceptable price.

Agriculture in Can Tho City has been building the large field model (LFM) since the Summer-Autumn crop 2011 (with a scale of 400 ha in Vinh Thanh District). The model has been expanded and became the “large field” movement by 2015 with an area of over 17,630 ha/crop, accounting for over 20% of the rice cultivation area. By 2018, the city continued to expand the model with 100 LFMs and the area was 25,386 ha. The large field model has promoted the linkage among farmers and creates a connection between farmers and businesses. Also, it encourages the application of scientific and technological advances in producing and consuming products. As a result, farmers and businesses are mutually beneficial when production costs decrease, product quality and price increase, thereby reducing negative impacts on the environment. With the participation in the linkage of product producing and consuming of over 20 enterprises, the profits of farmers participating in large field models increased from 2.95 to 5.5 million/ha.

Currently, the development of LFM is facing difficulties and challenges. Firstly, limitation in farmers' awareness about the long-term benefits of production and consumption linkage. Secondly, inequality in farmers' production level and fragmented farming area. Thirdly, waterway and land transport are not completion, so it affects mechanization progress in harvesting, purchasing and transporting rice. Finally, a shortage of resources procuring rice from farmers, especially during the peak harvest period. Therefore, it shows that the linkage in producing and consuming rice between farmers and enterprises in large field models at Can Tho City is dealing with many potential risks.

2. THEORETICAL FRAMEWORK AND RESEARCH MODEL

2.1 Risk definition

Risk is a common concept; almost anyone knows about this category. However, there is no unified definition of risk. Different authors in different schools give various meanings of risk. Some explanations can be noted as follows: According to Frank Knight (1921), the risk is the measurable uncertainty. Allan Herbert Willett (1951) stated that risk is uncertainty that may be related to unexpected events. Irving Preffer (1956) defined that risk is a combination of coincidences that can be measured by probability. Risk is a measurable uncertainty, if risk management is conducted well, it will bring opportunities; On the contrary, enterprises will have to accept losses (Doan Thi Hong Van et al., 2013). The above definitions are not completely similar, but they all refer to the two issues, (i) Uncertainty; (ii) A possibility: an unexpected event, a loss.

2.2 Research model

The research model focuses on identifying factors affecting the linkage risk in producing and consuming rice between farmers and enterprises in the large field model. Based on the theoretical basis of Ngo Quang Huan et al., (1998), Doan Thi Hong Van et al., (2013), as well as the theoretical framework of related researches. The study proposed research model for "Factors affecting the linkage risk in producing and consuming rice between farmers and enterprises in the large field model" is as follows:

The impact of price on the linkage risk in producing and consuming rice between farmers and enterprises

According to experts, after considering production cost factors, if farmers are satisfied with the price, they will continue to cooperate with buyers (Ulaga and Eggert, 2006; Barry et al., 2008). Research results of Minot (1986) showed that enterprises find it difficult to contract with farmers because farmers often sell products to traders at a higher price than the price in the contract. Besides, Tran Thi Lam Phuong et al. (2015) have demonstrated that price affects the cooperation relationship between buyers and sellers. According to a study by Tru and France (2009), the risk of price changes was said to have the most significant impact on their production efficiency. Therefore, hypothesis H1 is proposed as follows, *H1: The price difference is positively correlated with the linkage risk in producing and consuming rice between farmers and enterprises.*

The impact of terms of payment on the linkage risk in producing and consuming rice between farmers and enterprises

According to Zhang and Hu (2011), terms of payment are an essential factor in the relationship between farmers and buyers. Enterprises often do not pay money immediately to farmers after purchasing rice. It takes about 5-7 days for enterprises to pay money. This brings farmers insecurity because the business has collected their rice, but they still cannot get the money. Farmers may face many risks if the rice price in the market decreases leading to loss of business, enterprises are unable to pay or prolong the payment time (Tran Quoc Nhan and Do Van Hoang, 2013). Therefore, the payment method in the relationship with enterprises is always a problem for farmers because their resources are limited. According to research by Tran Quoc Nhan and Do Van Hoang (2013), the payment for rice purchase is time-consuming due to paperwork. Hence, hypothesis H2 is proposed as follows, *H2: Terms of payment are negatively correlated with the linkage risk in producing and consuming rice between households and enterprises.*

The impact of production scale on the linkage risk in producing and consuming rice between farmers and businesses

Tran Quoc Nhan and Do Van Hoang (2013) have demonstrated that the size of the rice cultivation area is related to the decision to join the contract of enterprises. Pratap et al. (2008) found that factors affecting farmers' decision to participate in farming contracts are land resources, and the influence is positive. Nguyen Minh Ha and Tran Van Tri (2018) have demonstrated that the production area is statistically significant with the level of 90%. Households with large cultivation areas are easier to participate in the large field model than those who have smaller areas. It is because benefits are shown clearly in a large cultivation area. The hypothesis H3 is proposed as follows, *H3: The scale of production is negatively correlated with the linkage risk in producing and consuming rice between households and enterprises.*

The impact of enterprises' support on the linkage risk in producing and consuming rice between farmers and enterprises

Ulaga and Eggert (2006) stated that support services reflect the support of collectors with farmers to create better quality products. Research by Bhagat and Dhar (2014) showed that cooperation, trust and caring from buyers affects farmers' satisfaction positively, thereby contributing to maintaining the long-term relationship. In this study, the support is shown through the introduction and supply of rice varieties, pesticides as well as technical guidance on rice production techniques for households. Several businesses involved in large field models have provided farmers with information on market trends and better production methods.

When farmers engage in contractual production, the risks in production increase because they start to apply new technologies transferred from the enterprises while they are familiar with traditional methods. Besides, the input cost provided by enterprises is sometimes higher than those who are from agricultural supply stores (Tran Quoc Nhan and Do Van Hoang, 2013). Therefore, hypotheses H4 and H5 are stated as follows:

H4: Technical support negatively correlates with the linkage risk in producing and consuming rice between farmers and enterprises.

H5: Input support is negatively correlated with the linkage risk in producing and consuming rice between farmers and enterprises.

Impact of the educational background of farmers on the linkage risk in producing and consuming rice between farmers and enterprises

Pratap et al. (2008) found that the factor influencing farmers' decision to enter into farming contracts was the education level. A high level of education leads to the high ability to enter linkage contracts. Research by Thai Thanh Ha (2005), Nguyen Minh Duc (2010), Nguyen Quoc Nghi et al. (2010) indicates that the educational level of farmers influences the production

efficiency of households. Nguyen Quoc Nghi and Le Thi Dieu Hien (2014) prove that farmers with a high level of education and actively participate in technical training courses could handle risks in the production process. Also, the application of technological advances into the production process helps farmers achieve better results. Hypothesis H6 is proposed as follows, *H6: The education level of the main producer is negatively correlated with the linkage risk in producing and consuming rice between farmers and enterprises.*

The impact of the number of years farmers participate in linking the linkage risk in producing and consuming rice between farmers and enterprises

The more years a farmer is engaged in agricultural production, the more experience and knowledge he has about the characteristics of the production type. The experience helps the farmer avoid risks and improve high production efficiency. The household has many levels of experience in the production; they easily predict and respond to production risks; Thereby contributing to minimize damage and bring efficiency in production (Nguyen Quoc Nghi and Nguyen Thi Ngoc Yen, 2014). Research by Saenz and Ruben (2004) pointed out that farmers involving in short-term linkage contracts are more likely to break contracts than those with many years joining linkage contracts. Therefore, hypothesis H7 is proposed as follows, *H7: The number of years farmers participate in the linkage has an inverse correlation with the linkage risk in producing and consuming rice between farmers and enterprises.*

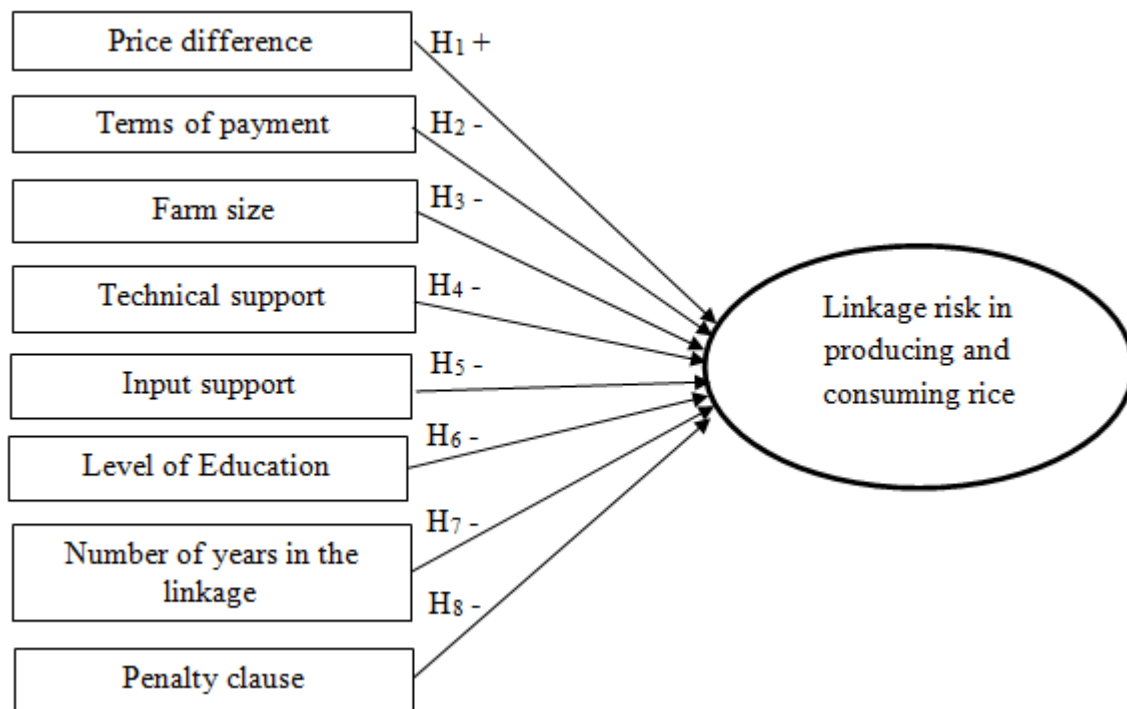
Impact of penalty clauses on the linkage risk in producing and consuming rice between farmers and enterprises

The benefits of the contract are not enough "attractive" to farmers is one of the principal reasons leading to poor contract performance between farmers and enterprises in Vietnam (Tran Quoc Nhan and Ikuo Takeuchi, 2012). When signing a linkage contract on rice production, enterprises are completely in control of the farmers in making contractual terms. Enterprises take advantage of their monopoly position to create conditions that are beneficial to them and detrimental to farmers; this can affect contract performance (Tran Quoc Nhan and Do Van Hoang, 2013). Contract clauses have positive impacts on contract performance between involved parties. The effects can be the application of a floor price policy, the requirement for specialized investments from each party, as well as the application of bonuses and penalties. They help improve the contract breaking from farmers (Guo and Jolly, 2008). Hence, hypothesis H8 is proposed as follows, *H8: Application of penalty clauses is negatively correlated with the linkage risk in producing and consuming rice between farmers and enterprises.*

Based on the results of group discussions with 8 farmers have many years of experience in rice production and consumption in the large field model, the study identifies the linkage in

producing and consuming rice between farmers and enterprises includes three types of risks, (1) price risk, (2) payment method and payment time risk, and (3) rice purchasing time risk. Therefore, the depended variable is linkage risk in producing and consuming rice between farmers and businesses; which is a measure of the number of types of risks that occurred in the nearest crop. That is the Winter-Spring crop 2018-2019. Thus, the depended variable is a measure in the form of positive integers from 0 to 3. Each positive integer number indicates the different risks types. Number 0 means there is no risk; the linkage is in good condition. Number 1 means one of the three types above occurs. Number 2 means two of the three types above happen. Number 3 means three types of risk occur. The model studies “Factors affecting the linkage risk in producing and consuming rice between farmers and enterprises participating in large field model at Can Tho City is proposed in figure 1.

Figure 1: The proposed research model



Source: Author’s proposal, 2019

Table 1: Interpretation of observed variables in the research model

Factor	Definition	Expected Sign	Unit of measurement	Reference sources
Price difference	The absolute value of the difference between the price in the contract and the actual price at the time of harvest	+	Quantitative (Thousand dongs)	Ulaga and Eggert (2006), Tru and France (2009), Tran Thi Lam Phuong et al. (2015)
Terms of payment	Payment under the contract (1: The payment follows regulations and 0: The payment does not follow regulations)	-	Nominal (1/0)	Zhang and Hu (2011), Tran Quoc Nhan and Do Van Hoang (2013)
Farm size	The total area of rice cultivation land of farmers	-	Quantitative (1000m ²)	Tran Quoc Nhan and Do Van Hoang (2013), Pratap et al. (2008)
Technical support	Technical support in the contract (1: There is technical support and 0: There is no technical support).	-	Nominal (1/0)	Ulaga and Eggert (2006), Bhagat and Dhar (2014), Rehber, (2000)
Input support	The total amount of money supported by the enterprise (including seeds, fertilizers, pesticides, and money) to contracted households (per 1,000 m ²)	-	Quantitative (Thousand dongs)	Ulaga and Eggert (2006), Bhagat and Dhar (2014), Tran Quoc Nhan and Do Van Hoang (2013)
Level of Education	The educational level of the main producer at the time of researching	-	Quantitative (Years spent at school)	Nguyen Minh Duc (2010), Nguyen Quoc Nghi và Le Thi Dieu Hien (2014)
Number of years in the linkage	Number of years farmers participating in linkage contracts with enterprises	-	Quantitative (Years)	Saenz and Ruben (2004), Nguyen Quoc Nghi and Nguyen Thi Ngoc Yen (2014)
Penalty	The penalty is imposed	-	Nominal	Tran Quoc Nhan and

Factor	Definition	Expected Sign	Unit of measurement	Reference sources
clause	when violating the contract (1: fine is applied and 0: fine is not applied)		(1/0)	Ikuo Takeuchi (2012), Guo and Jolly (2008)
Linkage risk	Number of types of risks occurring when participating in the linkage contract in the most recent case		Count data	Allan Willett (1951), Doan Thi Hong Van et al. (2013)

Sources: Author's analysis, 2019

3. RESEARCH METHODS

3.1 Analytical method

In previous studies, the production-consumption linkage risks were measured in the form of Dummy variables (receive value one if the risk occurs or value 0 if there is no risk). The binary regression analysis method (Logit or Probit) is suitable to be used (Chianu et al., 2007; Nkegbe et al., 2011). However, the difference of this study is that the linkage risk in producing and consuming rice between farmers and enterprises is a measure of count data. The number of types of risks occurring is counted from 0 to 3. According to Cameron and Trivedi (1998), Julie and Paul (2019), the Poisson regression method is used when the depended variable is measured in the form of an integer. Therefore, applying the Poisson regression analysis method is appropriate.

3.2 Data collection method

The study uses the quota sampling method. To categorize the surveyed objects, the criteria used are Group of farmers with linkage risks and a group of farmers with no linkage risks. The study conducted the survey on three districts with the largest field areas in Can Tho City, including Vinh Thanh, Thoi Lai, and Co Do. The survey sample size ensured the statistical significance. According to Tabachnick and Fidell (1996), the minimum sample size in the regression analysis was calculated by the formula $50+8m$ (m: number of independent variables). The research model is set up with eight independent variables; this means the minimum sample size is 114 observations. The study has surveyed 215 farmers in 3 districts the largest area and number of households participating in the large field model in Can Tho City, in which Vinh Thanh District with 100 households, Thoi Lai District with 44 households, and Co Do District with 71 households.

4. RESEARCH RESULTS AND DISCUSSION

4.1 Evaluate the suitability of the research model

According to Cameron and Trivedi (1998), Poisson regressions are used when the dependent variable is in the form of a positive integer of the event to be measured over a given time. This method is used to model the data. Then, it will be used to assess the relationship between the predictor and the confounding variable if the mean value and standard deviation of the variables are not equal (Octavio and Steven, 2000). Table 2 presents the descriptive statistical results of the dependent and independent variables in the proposed research model.

Table 2: Descriptive statistics results of variables in the research model

Variables	Min	Max	Mean	Standard deviation
Terms of payment (1: Yes, 0: No)	0	1	0.57	0.50
Penalty clause (1: Yes, 0: No)	0	1	0.32	0.47
Technical support (1: Yes, 0: No)	0	1	0.63	0.48
Farm size (1000m ²)	4	110	23.29	17.44
Input support (Thousand dong/1000m ²)	0	500	178.83	100.25
Number of years in the linkage (Year(s))	1	8	4.23	3.18
Level of Education (Years spent at school)	0	12	5.83	2.69
The price difference (Thousand dongs/Kg)	0	2,8	1.13	0.97
Linkage risk (Count data)	0	3	1.21	0.74

Source: Survey data of 215 households participating in the large field model, 2019

Based on the statistical results described in table 2; the research data satisfies the Poisson regression requirement: (1) The dependent variable "linkage risk" is a measure of count data. Its average value and standard deviations are not equal, and the mean value is smaller than 10 (Julie and Paul, 2019). (2) The independent variables measuring the linkage risk include quantitative and dummy variables (1/0). The average values and standard deviations of independent variables are not equal. Therefore, it is appropriate to apply the Poisson negative binomial regression method (Bashiru et al., 2014; Octavio and Steven, 2000; Cameron and Trivedi, 1998).

Before applying Poisson regression analysis, evaluation of the suitability of the dependent variable "the linkage risk" was conducted. Results of the Poisson dispersion test (1-Samples K-S) on the dependent variable showed that the Asymp Sig. (2-tailed) = 0.001 < 0.05 is statistically significant. The research data is suitable for the next step of Poisson regression.

4.2 Factors affecting the linkage risk in producing and consuming rice between farmers and enterprises

The study used Poisson regression analysis to assess the level of the linkage risk in rice production and consumption between farmers and enterprises at Can Tho City in the Winter-Spring crop 2018-2019. The analytical results are shown as follows:

Table 3: Analytical results on the linkage risk in rice production and consumption between farmers and

Variables	Coefficient (B)	Exp (B)	Significance level (Sig.)	Value/df
Constant	0.578	1.782	0.028**	
Price difference	0.367	1.443	0.000***	
Terms of payment	-0.263	0.769	0.060*	
Farm size	-0.003	0.997	0.490 ^{ns}	
Technical support	-0.299	0.742	0.029**	
Input support	-0.001	0.999	0.085*	
Level of Educational	0.009	1.009	0.712 ^{ns}	
Number of years in the linkage	-0.053	0.948	0.024**	
Penalty clause	-0.352	0.704	0.059*	
Omnibus Test ^a . Sig			0.000***	
Deviance				0.360

Source: Survey data of 215 households participating in the large field model, 2019

Note: ***, **, and * mean significant at 1%, 5% and 10% significant levels, respectively

Table 3 showed the follows:

The value/df Deviance: $0.05 < 0.360 < 1$. This shows that the independent variables are distinct and not correlated with each other (Cameron and Trivedi, 1998; Julie and Paul, 2019).

Omnibus Test^a coefficient Sig = $0.000 < 0.05$ is statistically significant. This means that the linkage risk in rice production and consumption between farmers and enterprises is influenced by at least one variable included in the model. The result in table 3 indicates that six variables are statistically significant. They affect to the linkage risk, including: (1) Different selling price between the contract price and the market price at the time of purchase; (2) Terms of payment; (3) Technical support; (4) Input support; (5) Number of years in the linkage; and (6) Penalty clauses. The level of impact of independent variables on the dependent variable “linkage risk” is explained based on exponentiation Exp (B). This explains as follows:

The price difference: statistically significant at the level of 1%, which is consistent with the initial hypothesis. The price difference is positively correlated with the linkage risk in rice production and consumption between farmers and enterprises. That is, the greater the level of the price difference between the contract price and the market price at the time of purchase, the higher the degree linkage risk. This result is consistent with the research by Tran Thi Lam Phuong et al. (2015). Price is an essential factor influencing the relationship between buyers and sellers. Because rice is a seasonal product and is influenced by many factors in the market, the price agreement between farmers and enterprises is relative. The market price determines about 71.6% of the price at the time of purchase. It pluses from VND 50 to VND 100/kg if there is a fluctuation between the market price and the contract price. However, there is only 17.2% of households selling rice to enterprises at a price higher than the contract price. There is 68.4% of households selling rice at a price lower than the contract price. The reason is that when the market rice price is lower than the contract price, enterprises decide to leave the deposit and do not purchase the rice. Farmers still wait for enterprises to come and purchase because the contract says that farmers can only harvest on the purchasing date. The long waiting time leads to a loss in the rice quality, thereby the actual price sold at this time is lower than the contract price.

Terms of payment: statistically significant at the level of 10% and consistent with the research hypothesis. As the rice price in the market increases, farmers tend to break contracts to sell rice at higher prices. When the rice price in the market drops, enterprises refuse to make payment terms on time (generally, these terms are unclear). About 56.7% of enterprises have payment conditions in the contract, of which 66.5% pay on time. This proves that the percentage of enterprises delay the payment is still high; therefore, the linkage risk is inevitable. Hence, if terms of payment are strictly followed, the linkage risk in producing and consuming rice between farmers and enterprises is limited. This finding is consistent with that of Nguyen Thi Lam Phuong et al. (2015). The research has proved that enterprises often do not make the payment immediately after finishing the purchase. They pay after 6-15 days that makes farmers worry because their rice has been collected, but they do not have money "in hand". Farmers may face difficulties if the rice price in the market goes down. This leads to business loss and enterprises are not able to pay or extend the payment time (Tran Quoc Nhan and Do Van Hoang, 2013).

Technical support: This variable is inversely correlated with associated risks and is statistically significant at the level of 5%. When farmers engage in contract production, they face challenges in applying new technologies transferred from enterprises. Farmers are still familiar with traditional methods and are not able to get used to new technologies (Rehber, 1998). Therefore, the more technical support enterprises have, the lower the risk of linkage. The survey showed that 37.2% of the households participating in the large field model do not receive technical

guidance from enterprises during the time of contracts. In some cases, enterprises provide farmers with technical guidance, but it is not effective. Such as the survey has pointed out that only 15.2% of households agree that the reason for joining the contract of rice production and consumption is the technical support. These results are in line with previous studies. Contractual production brings farmers easier access to technical and market information. Also, it helps farmers improve their knowledge of production techniques and ensure the market output for small-scale farmers (Minot, 1986; Rehber, 1998).

Input support: statistically significant at the level of 10% and inversely correlated with the linkage risk. The research result indicates that enterprises' input support for households fluctuates from VND 0 to VND 500,000 with an average of nearly VND 179,000/1000m². This support amount is low compared to the average production cost (more than 2 million VND/1000m²). This means enterprises do not pay much attention to input support for farmers. 30.2% of the households have said that the reason for joining the contract is that they expect to receive support from seeds and agricultural materials. There are 21.9% of households have confirmed that seed and agricultural materials supported by enterprises have higher quality than those that farmers buy themselves. The results are consistent with studies by Ulaga and Eggert (2006), Bhagat and Dhar (2014).

The number of years involved in the linkage: statistically significant at the level of 5% and inversely correlated with the linkage risk, which is consistent with the hypothesis. This means that the more years farmers have engaged in producing and consuming rice with enterprises, the linkage risk between the two parties decreases. Therefore, the knowledge and confidence of farmers are improved. This result shows the contract compliance between the participants, and also consistent with the research by Saenz and Ruben (2004). Farmers with a short time participating in linkage contracts are more comfortable to break the contract than those who have more contracts. The more years a household engages in the production, the more experienced it will be to predict and respond to risks, thereby contributing to minimize damage and enhance production efficiency (Nguyen Quoc Nghi and Nguyen Thi Ngoc Yen, 2014).

Penalty clauses: The *penalty clauses* influence the linkage risk. The coefficient is negative and significant at 10% The analysis results indicate penalty clauses are included in the contract and are strictly followed. The linkage risk in rice production and consumption between farmers and enterprises will be reduced. However, about 67.9% of enterprises do not have a penalty clause in the linkage contract. Only 32.1% of them have applied the penalty terms in the contract, such 10% upon the total contract value and the deposit from enterprises. Besides, the contract only represents the expected harvest amount; there is no exact price identified. It is hard to determine the contract value as well as the penalty amount. Besides, the parties involved are not serious in

enforcing the contract terms, so there is no compensation for the late purchase. Therefore, the linkage contract should specify the penalty and require the parties to follow to minimize the risks. This result is consistent with the research by Guo and Jolly (2008) which said that contract terms have a positive influence on the performance of the contract.

5. CONCLUSIONS

In general, among the eight factors included in the research model, six factors are statistically significant at the significance level from 1% to 10%. The impact of the factors on the linkage risk in producing and consuming rice between farmers and enterprises from high to low respectively is the price difference (44.3%); Penalty clauses (29.6%); Technical support (25.8%); Terms of payment (23.1%), Number of years in the linkage (5.2%); and Input support (0.1%). The research results will be an essential scientific basis for the local agriculture sector to refer to, develop an action program to limit linkage risks and promote the development of the large field model in Can Tho City.

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