Incentive Contract Between FPLs and TPLs Considering Unfairness Aversion in Agricultural Product Financing

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Abstract*-Agricultural products financing broadens the application range of inventory financing, but agricultural products financing relies on a high level of logistics service providers, which is called the fourth-party logistics(FPLs) because of agricultural products' slow deterioration, difficulty for transport and storage etc. FPLs will subcontract logistics tasks to the third-party logistics (TPLs) after they accept the tasks from banks. TPLs' effort will influences FPLs' profits, as well as the relationship between FPLs and banks. Thus it is significant to make TPLs put more effort into the operation. This paper introduces FPLs into model of the business and uses principal-agency theory to investigate incentive contracts between a FPL and a TPL. Here, we establish a multi-task principal-agent model, and considers situations with TPLs' unfairness aversion. Results show that TPLs with unfairness aversion will exert extra effort when TPLs provide a higher reward. The stronger the sense of the TPLs' fairness aversion is, the more the TPLs will increase extra effort, thus, FPLs gain more profits compared with that in traditional principal-agent mode.

Keywords- Agricultural Product Financing; Third-party Logistics (TPLs); Fourth-party Logistics (FPLs); Incentive Contract

I. INTRODUCTION

Since its introduction, inventory financing has aroused wide attention. Inventory finance theory is continually improving, however, there is little literature on agricultural products financing [1]. The emergence of agricultural products financing provides an effective way of providing financing for rural cooperatives, agricultural enterprises, and farmers. Agricultural products financing is that ASMEs (agricultural small-medium sized enterprises) place agricultural products into warehouses as collateral for loans. The security of the loan depends on the collateral and the ASME's operating conditions. This is a typical mode with three participating parties: financial institutions, logistics enterprises and customers [2]. In this business, logistics enterprises play an important role, similar to a bridge between banks and ASMEs. On the one hand, they provide services of value assessment, decision-making consultation, information sharing, storage, transportation etc.. On the other hand, they provide professional logistics services to customers. In other word, it is necessary for logistics enterprises to participate in the process in order to effectively manage agricultural product financing. There are two main reasons for the participation of third-party logistics (TPLs) in agricultural product financing in China: (1) Banks lack appropriate storage facilities to keep the guaranteed inventories; (2) Banks lack capability to transfer or store inventories, and are unable to evaluate the value the products or monitor fluctuation in value. In practice, many logistics enterprises participate in agricultural product financing [3]. Guangdong Nanchu Warehousing Management Co. Ltd began to develop the business through cooperating with several banks such as Shenzhen Development Bank, Guangdong Development Bank, Shanghai Pudong Development Bank, Bank of Communications. In 2004, the value of loans from banks through inventory financing totaled about 6 billion RMB. In 2006, China National Materials Storage and Transportation Corporation (CMST) made agreements with several banks to join in the activity; until the end of the year, the amount of loans through the business was more than 11.1 billion RMB.

However, in our current study, logistics enterprises are defined as TPLs, providing basic logistics service such as transportation, storage, supervision etc., and the collateral is limited to inventory. Li [4] applied game theory to study incentive mechanisms between banks and logistics enterprises under completed information. The results show that compared with inspiring loan enterprises, banks can reduce more business risk through inspiring logistics companies. Xu and Wang [5] researched the design of incentive and supervised mechanisms between banks and TPLs. Their research shows that when loan enterprises are involved the business transactions, and help banks incentivize and supervise TPLs together, the banks will reduce costs. Wei Yan [6] researched the design of incentive contracts between banks and TPLs. Wang and Xu [7] researched the incentive contracts between banks and TPLs considering TPLs' irrational behaviors. They found that when banks pay more to TPLs, TPLs exert more efforts to return profits to banks. Li et al [8] examined the problem that banks prevented TPLs and loan enterprises from collusion under asymmetric information, He et al [9] used the game theory method, and also studied the question that banks prevent TPLs and loan enterprises from collusion to loan. Zhang and Wang [10] extended the catastrophe progression model and applied it to diagnose the project risk of inventory financing. He et al [11] presented an application of Copula-GARCH model in the dynamic estimation of the inventory portfolios' VaR with rolling time window based on the principle of risk diversification of Markowitz's.

However, the above research has not considered that with FPLs involved in the transactions and "agricultural products" financing, FPLs work as an integrator of supply chain and provide a complete supply chain solution through integration of

DOI: 10.5963/IJEME0501004

their own technology, information and other resources. FPLs participation overcomes the bottleneck of agricultural products financing, and contributes to smooth development of the transactions. In the transactions, banks will entrust logistics task to FPLs because of their advantages. Usually FPLs will not complete these tasks on their own; they will subcontract them to TPLs. Naturally, whether TPLs complete logistics tasks with high quality or not, not only has an impact on the successful development of agricultural product financing, but also on the long-term stable relationship between FPLs and banks. Thus, design of an optimal contract between FPLs and TPLs is one of the most important issues in agricultural product financing. TPLs can ensure inventories' safety only when they are fully under supervision and control. It is the TPL that sets up the warehouse, makes sure that agricultural product properly segregated and easily identified, marks premises, and excludes any borrower. As warehouse owner, TPLs can determine the feasibility of starting a specific agricultural product financing business. Therefore, it is necessary for FPLs to motivate TPLs through an appropriate incentive contract, in which TPLs are strongly encouraged to properly administer agricultural products on behalf of FPLs. As to the contract between FPLs and TPLs, Xu et al. [9] discussed the question, and considered the situation that FPLs would help TPLs during their course of completing the logistics tasks. However, this paper is different from the existing literature: (1) the collateral is agricultural products. Agricultural product financing expands the scope of inventory financing, it is a new path to crack the financing difficulties as well; (2) FPLs join in the business. FPLs work as an integrator of a supply chain, possessing information consulting, logistics technology and other resources, and can provide a set of optimization scheme for agricultural product financing. Their participation is good for reduction of the risks; (3) TPLs' unfairness aversion behavior is considered. In the current study, TPLs are assumed to be completely rational, namely regarding profit maximization as the goal, which is not fully consistent with situation in practice. Most current economic models assume that people purse only their own material self-interest and do not care about "social goals". One exception to self-interest which has received some attention by economists is simple altruism: people may care not only about their own well-being, but also about the well-being of others. Yet psychological evidence indicate that most altruistic behavior is more complex: people do not seek uniformly to help other people; rather, they do so according to how generous these other people are being. Indeed, the same people who are altruistic to other altruistic people are also motivated to hurt those who hurt them. If somebody is being nice to you, fairness dictates that you be nice to him. If somebody is being mean to you, fairness allows—and vindictiveness dictates—that you be mean to him [11]. Therefore, FPLs show kindness to TPLs, TPLs will friendly give double return.

This paper is organized as follows. In Section 2, we explain the "unfairness aversion" and define the model of agricultural product financing in an environment with uncertainty and moral hazards, on the basis of some assumptions. In Section 3, we construct the model considering TPLs' unfairness aversion and analyze the question from two aspects. In Section 4, we discuss the application in the design of contract. Finally, Section 5 concludes the paper and gives suggestions: FPLs should consider the TPLs' behaviors when designing a contract.

II. UNFAIRNESS AVERSION AND MODEL HYPOTHESIS

A. *Unfairness Aversion and Relationship Between TPLs and FPLs*

Unfairness aversion refers to when someone is nice to you, you will be friendly to others, when others are unkind to you, and you are unkind to others in order to find fairness [12, 13]. Specifically speaking, if someone is willing to sacrifice their own material well-being to help those who are being kind, he is thought as friendly to others; if someone is willing to sacrifice their own material well-being to punish those who are being unkind, he is thought as not friendly to others. For this paper, when FPLs give more fixed rewards to TPLs, TPLs will pay extra efforts in return because of the pursuit of fairness, which makes it impossible for TPLs to obtain the maximum theoretical profit, but FPLs can increase their utility and income. In other words, following unfairness aversion behaviors, TPLs sacrifice their own material well-being to increase revenues for FPLs.

FPLs are a higher stage of outsourcing logistics, and integrate logistics activities, customers with integrated logistics operation program. Integrated logistics programs focus on the integration and optimization of the entire logistics system resources, which is different from TPLs' basic operations, such as shipping, storage, etc. [14, 15]. Fourth party logistics are responsible for the design and optimization of logistics schemes, subcontracting to third party logistics [16]. It is the only connection between the third party logistics and customers, management and supervision of the third party logistics, and share the risks and benefits of the logistics management with customers [17, 18]. The bank is willing to cooperate with FPLs in order to guarantee the security of the loan. However, FPLs don't usually provide logistics by themselves--they will subcontract tasks to TPLs. Naturally, whether TPLs finish the tasks or not will have an impact on FPLs' profit. Therefore, it is necessary for FPLs to design the contract in order to make TPLs put in more effort. In the work presented here, we design a contract between FPLs and TPLs applying the principle-agent model, and take unfairness aversion into account in the model.

B. *The Model*

Consider an SME, that relies on a bank for I units of working capital. Because of the lack of sufficient fixed assets, the SME needs to offer agricultural products as a collateral (it obtains loans from the bank through agricultural product financing). The bank provides the SME with I units of money, the interest rate is r, loan period is t. The interest SMEs pay to banks defined as $\psi = Irt$. The bank commissions logistics tasks, such as transportation, value evaluation, management, supervision,

DOI: 10.5963/IJEME0501004

price fluctuation detection, disposal of agricultural products, disposal and exchange of information to FPLs, and then FPLs subcontract these tasks to TPLs according to their own strengths.

A few assumptions are needed for a tractable model. We first assume that TPLs are not totally rational, that is, not pursuit of personal profit's maximization, and then assume that the number of TPLs joining business is $i\left(i=1,2....n\right)$. FPLs assess the result of tasks completion using five non-profit indexes, assuming assessment result is, $X_{ij}=\left(x_{i1},x_{i2},x_{i3},x_{i4},x_{i5}\right)$. Among them, x_{i1} denotes the value evaluation index, x_{i2} denotes the supervision index, x_{i3} denotes the transportation index, x_{i4} denotes the index of disposal of agricultural product when SMEs default, x_{i5} denotes information sharing index.

It is assumed that FPLs gives TPLs' rewards:

$$T\left(X_i\right)=\sum_{j=1}^{5}\beta_{ij}x_{ij}+\left(w_i+\delta_i\right)\quad\left(i=1,2,...n\right) \tag{1}$$

Wherein $T\left(X_i\right)$ defined as the reward to the TPLs given by the FPLs, w_i indicates that a fixed reward is paid for completion of all basic tasks, δ_i denotes a extra fixed reward to TPLs given by FPLs, β_{ij} is an incentive coefficient for completing tasks, proposed by the FPLs. Among them, $x_{ij}=A\left(a_{ij}+\Delta a_{ij}\right)+\varepsilon_{ij}$, the concrete function is as follows:

$$x_{i1}=A_{i1}\left(a_{i1}+\Delta a_{i1}\right)+\varepsilon_{i1}$$

$$x_{i2}=A_{i2}\left(a_{i2}+\Delta a_{i2}\right)+\varepsilon_{i2}$$

$$x_{i3}=A_{i3}\left(a_{i3}+\Delta a_{i3}\right)+\varepsilon_{i3}$$

$$x_{i4}=A_{i4}\left(a_{i4}+\Delta a_{i4}\right)+\varepsilon_{i4}$$

$$x_{i5}=A_{i5}\left(a_{i5}+\Delta a_{i5}\right)+\varepsilon_{i5}$$

To simplify analysis, it is assumed that the bigger the values of all indexes are, the better they are. Wherein, Δa_{ij} denotes extra effort TPLs offer as reaction to FPLs' kindness, $a_{ij}\ \left(j=1,2,3,4\right)$ denotes TPLs' effort for completing the task index, A_{ij} denotes abilities TPLs possess, such as operation processes, operational experience, technology, and the larger the value of A_{ij}, the easier TPLs complete the task. ε_{ij} denotes external factors affecting completion of tasks. It is assumed that $\varepsilon_{ij}\sim\left(0,{\sigma_{ij}}^2\right)$, and these factors are independent of each other.

It's assumed that FPLs benefit from service subcontract.

$$R_i\left(X_i\right)=\sum_{j=1}^{5}\eta_{ij}x_{ij},\ \left(i=1,2,.....n\right)$$

Wherein, η_{ij} is contribution coefficient, profits that FPLs' gain from all service subcontract are as follows:

$$\lambda=\sum_{i=1}^{n}\left(R_i-T_i\right)-\phi$$

It is assumed that FPLs are risk neutral and act to maximize its expected profits; therefore, certainty equivalent income equals expected value of total earnings, that is:

$$H=E\left(\lambda\right)=\sum_{i=1}^{n}\left(\sum_{j=1}^{5}\left(\eta_{ij}-\beta_{ij}\right)x_{ij}+\sum_{j=1}^{5}\beta_{ij}x_{ij0}-\left(w_i+\delta_i\right)\right)-Irt,\ \left(i=1,2,...n\right)$$

DOI: 10.5963/IJEME0501004

We also assume the function of the TPL's effort cost is C_i, and $C_i = \frac{1}{2} b_i \sum_{j=1}^{5} \left(a_{ij} + \Delta a_{ij} \right)^2$, $\left(i = 1, 2, \ldots n \right)$, and $C_i'\left(a_{ij} \right) > 0,\ C_i''\left(a_{ij} \right) > 0$.

Wherein, b_i is cost coefficient, related to its ability A_{ij}, the better the abilities or skills are, the smaller the value of b_i.

With above assumption and analysis, the TPLs' actual income:

$$M_i = T_i - C_i = \sum_{j=1}^{5} \beta_{ij} x_{ij} + w_i + \delta_i - \frac{1}{2} b_i \sum_{j=1}^{5} a_{ij}{}^2 \quad \left(i = 1, 2, \ldots n \right)$$

It is assumed that TPLs' risk type for risk aversion, the value of risk aversion is ρ_i, certainty of profits V_i are as follows:

$$V_i = E\left(M_i \right) - \frac{1}{2} \rho_i \operatorname{var}\left(M_i \right) = \sum_{j=1}^{5} \beta_{ij} x_{ij} + \left(w_i + \delta_i \right) - \frac{1}{2} b_i \sum_{j=1}^{5} \left(a_{ij} + \Delta a_{ij} \right)^2 - \frac{1}{2} \rho_i \sum_{j=1}^{5} \beta_{ij}{}^2 \sigma_{ij}{}^2, \left(i = 1, 2, \ldots n \right).$$

III. CONTRACT BETWEEN FPLS AND TPLS WITH UNFAIRNESS AVERSION

A. Contract with τ Being Constant

Refer to the relevant sections, FPLs' profit maximization problem is:

$$\underset{\beta_{ij}, w}{Max}\, H = E\left(\lambda \right) \tag{2}$$

$$s.t. IC : V_i \geq v_i + \tau_i \quad \left(i = 1, 2, \ldots n \right) \tag{3}$$

$$IR : a_{ij} \in \arg\max V_i = E\left(M_i \right) - \frac{1}{2} \rho_i \operatorname{var}\left(M_i \right) \quad \left(i = 1, 2, \ldots n \right), \ \left(j = 1, 2, \ldots 5 \right) \tag{4}$$

Wherein, τ denotes retained earnings TPLs increase.

This problem (4) is found to have a unique solution, which is the following:

$$\sum_{j=1}^{5} \Delta a_{ij}{}^2 = \frac{2\left(\delta_i - \tau_i \right)}{b_i}$$

Here we use $\Delta a_i{}^2$ to substitutes for $\sum_{j=1}^{5} \Delta a_{ij}{}^2$, and then

$$\Delta a_i{}^2 = \frac{2\left(\delta_i - \tau_i \right)}{b_i},$$

That is,

$$\Delta a_i = \sqrt{\frac{2\left(\delta_i - \tau_i \right)}{b_i}}$$

Proposition 1. TPLs will increase extra effort if $\delta_i \geq \tau_i$, $\Delta a_i \geq 0$.

According to above analysis, TPLs are not totally rational, so $\delta_i \geq \tau_i$ is possible and reasonable, that is, TPLs will pay more efforts in return when FPLs' offer more fixed rewards.

With the existence of the TPLs' behavior of unfairness aversion, the FPLs' profits are:

DOI: 10.5963/IJEME0501004

$$H' = E(\lambda') = \sum_{i=1}^{n}\left((\eta_i - \beta_i)\left(\frac{A_i\beta_i}{b_i} + \sqrt{\frac{2(\delta_i - \tau_i)}{b_i}}\right) + \sum_{j=1}^{5}\beta_{ij}x_{ij0} - (w_i + \delta_i)\right) - Irt \tag{5}$$

FPLs will maximize their own profits through choosing the optimal δ, by Eq. (5), and then:

$$\frac{\partial H'}{\partial \delta} = \sum_{i=1}^{n}\left(\frac{2(\eta_i - \beta_i)\sqrt{b_i}}{\sqrt{2(\delta_i - \tau_i)}} - 1\right),$$

By $\frac{\partial H'}{\partial \delta} = 0$, we get the optimal δ:

$$\delta_i = \tau_i + 2b_i\sum_{j=1}^{5}(\eta_{ij} - \beta_{ij})^2 = \tau_i + 2b_i\sum_{j=1}^{5}\eta_{ij}^2\left(1 - \frac{A_{ij}^2}{A_{ij}^2 + b_i\rho_i\sigma_{ij}^2}\right)^2 \tag{6}$$

Because $\eta_{ij} \ge 0$, $1 - \frac{A_{ij}^2}{A_{ij}^2 + b_i\rho_i\sigma_{ij}^2} \ge 0$, $\eta_{ij}^2\left(1 - \frac{A_{ij}^2}{A_{ij}^2 + b_i\rho_i\sigma_{ij}^2}\right)^2 \ge 0$.

By Eq. (6), the relationship between δ and τ: $\delta_i \ge \tau_i$.

Put Eq. (5) into Eq. (4), we get the FPLs' profits:

$$H' = E(\lambda') = \sum_{i=1}^{n}\left(\sum_{j=1}^{5}\frac{A_{ij}\beta_{ij}(\eta_{ij} - \beta_{ij})}{b_i} + 2(1 - b_i)\sum_{j=1}^{5}(\eta_{ij} - \beta_{ij})^2 + \sum_{j=1}^{5}\beta_{ij}x_{ij0} - w_i - \tau_i\right) - Irt \tag{7}$$

Under the situation that the TPLs are rational, the FPLs' profits are following:

$$H = E(\lambda) = \sum_{i=1}^{n}\left(\sum_{j=1}^{5}\frac{A_{ij}\beta_{ij}(\eta_{ij} - \beta_{ij})}{b_i} + \sum_{j=1}^{5}\beta_{ij}x_{ij0} - w_i\right) - Irt \tag{8}$$

Comparing Eq. (7) with Eq. (8), and then:

$$H' = H + \sum_{i=1}^{n}\left(2(1 - b_i)\sum_{j=1}^{5}(\eta_{ij} - \beta_{ij})^2 - \tau_i\right)$$

Proposition 2. When $2(1 - b_i)\sum_{j=1}^{5}(\eta_{ij} - \beta_{ij})^2 \ge \tau_i$, $H' \ge H$.

The stronger TPLs' sense of unfairness aversion is, the smaller τ_i is, thus, the value of Δa_i is bigger when τ_i is sufficiently small, $2(1 - b_i)\sum_{j=1}^{5}(\eta_{ij} - \beta_{ij})^2 \ge \tau_i$.

B. Contract with τ Being Not Constant

When the TPLs' sense of unfairness aversion exists，the more the FPLs offer fixed rewards (δ). The fewer retained earnings (τ) the TPLs requires to increase, because TPLs will sacrifice their own material well-being in return. Therefore, there is a functional relationship between δ and τ. If we assume $\tau = y(\delta)$, and $y'(\delta) \le 0$. Then, FPLs' expected profits are following:

DOI: 10.5963/IJEME0501004

$$H' = E(\lambda') = \sum_{i=1}^{n}\left((\eta_i - \beta_i)\left(\frac{A_i\beta_i}{b_i} + \sqrt{\frac{2(\delta_i - y(\delta_i))}{b_i}}\right) + \sum_{j=1}^{5}\beta_{ij}x_{ij0} - (w_i + \delta_i)\right) - Irt \tag{9}$$

By Eq. (9), and then:

$$\frac{\partial H'}{\partial \delta} = \sum_{i=1}^{n}\left(\frac{2(\eta_i - \beta_i)(1 - y'(\delta_i))\sqrt{b_i}}{\sqrt{2(\delta_i - \tau_i)}} - 1\right)$$

By $\frac{\partial H'}{\partial \delta} = 0$, and then:

$$\delta_i = y(\delta_i) + 2b_i(1 - y'(\delta_i))^2\sum_{j=1}^{5}\eta_{ij}^2\left(1 - \frac{A_{ij}^2}{A_{ij}^2 + b_i\rho_i\sigma_{ij}^2}\right)^2$$

The FPLs' optimal profits are:

$$H' = H + \sum_{i=1}^{n}\left(2(1-b_i)(1 - y'(\delta_i))^2\sum_{j=1}^{5}(\eta_{ij} - \beta_{ij})^2 - y(\delta_i)\right) \tag{10}$$

Proposition 3. When $(1-b_i)(1-y'(\delta_i))^2\sum_{j=1}^{5}(\eta_{ij} - \beta_{ij})^2 - y(\delta_i) \ge 0$, $H' \ge H$.

The stronger the TPLs' sense of unfairness aversion is, the smaller $y(\delta_i)$ is. When $y(\delta_i)$ is small enough, $(1-b_i)(1-y'(\delta_i))^2\sum_{j=1}^{5}(\eta_{ij} - \beta_{ij})^2 - y(\delta_i) \ge 0$.

IV. RESULTS APPLICATION IN THE DESIGN OF CONTRACT

According to the new findings from the work presented here, FPLs can adopt the following approaches to designing a contract.

A. According to research findings, TPLs with unfairness aversion behavior increase extra efforts to return FPLs' behaviors for pursuit of fairness when receiving extra rewards, and amount of increasing effort is positively related to unfairness aversion behavior. The stronger unfairness aversion behavior is, the more additional effort, otherwise, the less effort.

B. The stronger the unfairness aversion is, the more additional fixed remuneration FPLs should give. If TPLs have a stronger behavior of unfairness aversion, the more rewards they receive, the harder they work in return, so FPLs will gain more profits.

C. If unfairness aversion is weak, the FPLs should consider whether profits increase or not when giving TPLs additional fixed remuneration. According to the research results, when the behavior is not strong enough, it is not certain that the extra fixed reward will increase FPLs' profits.

D. When TPLs firstly give extra effort, FPLs should pay attention to it and give a corresponding reward (mental or physical), this will make TPLs' sense of fairness to be met as they will work harder.

V. CONCLUSIONS

Agricultural product financing is an expansion of inventory financing. This business provides a new path for agricultural enterprises to overcome difficulties securing financing, which can increase of farmers' incomes, and improve agricultural modernization and rural economic development. However, the characteristics of agricultural product determine that the business is more dependent on high level of logistics enterprises, FPLs with the optimization ability joining in agricultural product financing effectively break business limitations. Based on analysis of characteristics of the business and FTLs which aim to curtail moral risk problems, this paper constructs a multi-task principal-agent model using the principal-agent theory. Results show that when FPLs provide TPLs with more fixed rewards, TPLs will provide more efforts to the return of FPLs' goodwill to meet the pursuit of fairness. This behavior will make TPLs' earnings relatively reduced, but increased FPLs'

DOI: 10.5963/IJEME0501004

revenue. This paper studies incentive contract between FPLs and TPLs for agricultural product financing, there are still many problems which need to be further explored about agricultural product financing, such as pricing of logistics service, the determination of value ratio, the selection of members, the test about prices fluctuation of agricultural products and so on.

ACKNOWLEDGEMENT

This paper is funded by youth project of Ministry of education of Humanities and Social Sciences (14YJC630152), China Postdoctoral Science Foundation (2014M562504XB), Science Technology Project of Chongqing Municipal Education Commission (KJ1400106) and Chongqing Postdoctoral Science Foundation (Xm2014070).

REFERENCES

[1] W. Li, “Simple Analysis of the Logistics Supply Chain of Agricultural Products in Financial mode,” *Logistics Engineering and Management*, vol. 33(9), pp. 44-45, 2011.

[2] Q. Lou, D. L. Zhu, and B. M. Chen, “A Third party Logistics Service Innovation: Financing Warehouse and Its Operation Model,” *China Business and Market*, vol. 2, pp. 11-14, 2002.

[3] Y.X. Li, G. Z. Feng, and Y. Xu, “Research on Loan-to-value Ratio of Inventory Financing under Randomly-fluctuant Price,” *System Engineering-Theory & Practice*, iss. 12, pp. 43-48, 2007.

[4] J. Li, Y. X. Yu, and G. Z. Feng, “Game Analysis based on Inventory Financing,” *Productivity Research*, iss. 20, pp. 49-50, 2007.

[5] P. Xu, Y. Wang, and J. Yang, “Incentive and Supervisory Mechanism of Banks to 3PL based on Warehouse Receipt Pledge of Common Principal,” *Science Research Management*, vol. 31(3), pp. 134-142, 2010.

[6] Y. Wei, C. Y. Sun, and B. Shuai, “Design of Incentive Contract between Banks and 3PL based on Inventory Financing,” *Logistics Technology*, iss. 6, pp. 73-77, 2010.

[7] Y. Wang and P. Xu, “The Incentive Mechanism of Banks to 3PL Considering the Factor of Justice Preference Based on FTW of Principal-Agent Model,” *Journal of Industrial Engineering/Engineering Management*, vol. 24(1), pp. 95-100, 2010.

[8] J. He, J. Wang, and X. L. Jiang, “Mechanism Design of Avoiding Collusion in Inventory Financing under Incomplete Information,” *Soft Science*, vol. 26(8), pp. 141-145, 2012.

[9] P. Xu, Y. Wang, and He Ding, “Incentive Contract between 4PL and 3PL Based on FWT of Unified Credit Mode,” *Journal of Industrial Engineering/Engineering Management*, vol. 26(3), pp. 50-54, 2012.

[10] Y. F. Zhang and Y. Wang, “The Research on Inventory Pledge Financing Risk’s Diagnosis Based on Catastrophe Progression Model,” *Journal of Industrial Technological Economics*, iss. 7, pp. 66-74, 2014.

[11] J. He, J. Wang, and X. L. Jiang, “The Price Risk Decision of Inventory Portfolio in Supply Chain Finance,” *Management Review*, vol. 25(11), pp. 163-176, 2013.

[12] M. Rabin, “Incorporating Fairness into Game Theory and Economics,” *The American Economics Review*, iss. 83, pp. 1291-1302, 1993.

[13] F. Ernst and K. M. Schmidt, “A theory of fairness, competition and cooperation,” *Quarterly Journal of Economics*, vol. 114(3), pp. 817-868, 1999.

[14] S Hertz and M Alfredsson, “Strategic development of third party logistics providers,” *Industrial Marketing Management*, vol. 32(2), pp. 139-149, 2003.

[15] F Fulconis, L Saglietto, and G Pache, “Exploning new competencies in the logistics industry: The intermediation role of 4PL,” *Supply Chain Forum: An International Journal*, vol. 7(2), pp. 68-77, 2006.

[16] G Stefansson, “Collaborative logistics managment and the role of third-party service providers,” *International Journal of Physical Distribution and Logistics Management*, vol. 36(2), pp. 76-92, 2006.

[17] Visser E J, “Logistics innovation in global supply chains: An empirical test of dynamic transantion-cost theory,” *Geo Journal*, vol. 70(2), pp. 213-226, 2007.

[18] Fulconis F, Saglietto L, and Pache G, “Strategy dynamics in the logistics industry a transactional center perspective,” *Management Decision*, vol. 45(1), pp. 104-117, 2007.

DOI: 10.5963/IJEME0501004