The Impacts of Microcredit in Supply Chain: Evidence from China

Zhixin Chen[1], Changluan Fu[2] and Zhonggen Zhang[3]

[1]Research Center for Leadership Science, Zhejiang University, Hangzhou, Zhejiang, 310028, China
Telephone: 86-571-88273612, Fax: 86-571-88273475, E-mail: sunychen@zju.edu.cn
[2]School of International Business, Zhejiang International Studies University, Hangzhou, Zhejiang, 310028, China
Telephone: 86-571-88257240, Fax: 86-571-88218274, E-mail: changluanfu@hotmail.com
[3]School of Management, Zhejiang University, Hangzhou, Zhejiang, 310028, China, Telephone: 86-571-88981533, Fax: 86-571-88273475, E-mail: zhgzhang@zju.edu.cn

ABSTRACT The purpose of this paper is to assess poverty impacts of a joint liability microcredit program targeted at rural households in supply chain. 86×2 sample data was obtained from the single-factor 2-level field experiment in rural China, t-test with paired samples was conducted to make a comparative analysis and SPSS v.21 was used. The findings indicate that joint liability for trading partners in warehouse receipts financing could reduce agricultural loan risks and mitigate the rural households' financing difficulties.

INTRODUCTION

Due to the adverse selection caused by asymmetric information, rural credit markets in most developing countries operate inefficiently, and rural households' credit rationing is generally serious (Bouquet et al. 2015; Cheng et al. 2014; Li et al. 2013) which may cause social problems, such as poverty (Amzat and Olutayo 2009), especially in low market access area (Gani and Adeoti 2011). In order to reduce the credit risks, lending institutions usually require borrowers to provide collateral. Compared to the "risky borrowers", marginal cost of the collateral from the "safe borrowers" is low, and they are willing to provide more collateral required for the loan, while the "risky borrowers" are unwilling to offer adequate collateral. Thus the "screening advice" is formed, which could separate the "safe borrowers" from the "risky borrowers" and screen the "risky borrowers" out (Niinimäki and Pekka 2015; Coco 1999).

Address for correspondence:
Dr. Changluan Fu
School of International Business,
Zhejiang International Studies University,
140 Wensan Road, Hangzhou,
Zhejiang, China 310012
Telephone: 86 -571-88257240
Fax: 86 -571-88218274
E-mail: changluanfu@hotmail.com

Unfortunately, in developing countries, rural households always lack qualified collateral. In this way, "screening advice" not only screens out "risk rural households", but also shuts the door on those "safe rural households" who are unable to provide qualified collateral. For this reason, collateral cannot be used as a device to reveal projects risk of rural households, which often lead to serious credit rationing problems in the rural credit market (Conning and Udry 2007).

In this situation, the joint-liability microcredit has been received much attention. However, in the traditional microcredit, the joint liability expanded within the individual's personal networks (Santarosa 2015) and resulted in client over-indebtedness and repayment problems in various countries. Yet, it remains unclear whether, and how, microcredit can help the rural households to improve their lives (Attanasio et al. 2015).

This paper provides evidence from a field experiment among 86 rural households in supply chain in ten villages of China. The aim of the experiment, in which rural households were randomly assigned to obtain access to warehouse receipts financing, credit rating loans from commercial bank, is to measure and compare the impact of both types of microcredit on mitigating the rural households' credit rationing in supply chain.

In supply chain, the use of warehouse receipts (WRs) as collateral to apply for a loan will

be a good idea, because rural households always have grain and other agricultural products that are temporarily reluctant to be sold due to low price at the period of output. If implemented properly, these products could make up for the lack of collateral, eliminate the credit risk, and improve access to rural finance.

However, only the collateral of WRs is inadequate to eliminate the credit risk. For WRs financing to be implemented successfully, there should be an appropriate legal environment, reliable well-functioning and adequately supervised warehouses. In addition, it is necessary to have a systematic collateral rules and a performance guarantee system to ensure the circulation of WRs, and thus to fundamentally assure the security of banks' credit funds and relive the credit constraints on rural households (Rangasamy 2013).

It is obvious that a regulated WRs system can mobilize agriculture credit by creating a secure collateral for banks (Varangis and Larson 1996), and ease access to finance at all levels in the marketing chain (Coulter and Onumah 2002). In a regulated WRs system, the core of the problem for WRs as a collateral to achieve effective control of risks is to determine the reasonable collateral loan rate (Guo and Zhang 2010; Ma and Qiu 2008).

However, in some developing countries, including China, there is not a regulated WRs system, the systematic rules of WRs collateral and the performance guarantee system that ensure the circulation of WRs have not been established. In this situation, how to use WRs collateral, eliminate the credit risk and relive the credit constraints on rural households? Current researches analyze the problem from the perspective of third party logistics selection (Xiao and Zhang 2013) and customer credit risk assessment (Li et al. 2012). There is, however, no formal analysis of how the relationship between the participants in the WRs collateral relives credit rationing of rural households. In this paper, we will research on the problem from the perspective of joint liability in the WRs collateral between rural households and their supply chain trading partner with the method of field experiment.

Objective

This paper proceeds as follows: section 2 proposes research hypothesis based on the case analysis and literature review, section 3 is the design of field experimental study, section 4 and section 5 present the empirical results and analysis, and section 6 give conclusions.

A Case Study

The Use of Cotton WRs as Collateral to Apply for Loan in Hebei and Other Places

Case Background

Jizhou City has been named as one of the national Top 100 cotton production cities (counties) in China, and the cotton planting areas of which are more than 40,000 acres. However, since the difficulties of cotton rural households in selling cotton, a large amount of cotton was kept long in stock, which in turn results in the financial difficulties of cotton rural households and enterprises. In response to this phenomenon, Jizhou Rural Credit Cooperatives Union tried to launch a new financial service - lint cotton WRs collateral loan in July 2009. Jizhou Xinsheng Cotton Industry Co. Ltd., which is the largest cotton enterprise in this city, has obtained its first lint cotton WRs collateral loan of 7 million CNY on November 27 from this Rural Credit Cooperatives Union. So far, Jizhou Rural Credit Cooperatives Union has opened up a new world in the field of credit support for agriculture. As at July 21, 2010, Jizhou Rural Credit Cooperatives Union has handled 147 transactions of WRs collateral in total for 63 cotton enterprises during the current cotton purchasing season, with a total amount of 108.33 million CNY. The promotion of WRs collateral loan has broken the bottleneck of applicants' difficulty in applying for loans because of the lack of qualified collateral and has effectively solved the problem of temporary demand for funds of cotton rural households and enterprises, which also become a new outstanding point of Jizhou Rural Credit Cooperatives Union in credit support for agriculture. With strict management, there is no risk loan among the total 147 transactions of 108.33 million CNY's WRs collateral loans, and both the recovery rate and interest rate are a hundred percent.

Methods for Loan

(1) Loan Applicants

Cotton purchase, sale and processing enterprises in rural areas, cotton cooperatives and a large number of cotton self-employed households.

(2) Credit Management Participants

The main participants are rural credit cooperatives or commercial banks, logistics and warehousing companies, and buy-back guarantor enterprises.

(3) Credit Management Process

Firstly, cotton business operators or companies take cotton as collateral and put them into the custody of the logistics and warehousing companies approved or designated by the bank; the storage materials must be insured, and the credit cooperatives shall be the first beneficiary in the insurance contract.

Secondly, borrowers apply for the collateral loan.

Thirdly, the loan bank, borrowing company, warehousing company and buy-back company sign a quadripartite co-operation agreement. Among of which, the bank and warehousing company will sign a supervision entrusting agreement, and the warehousing company shall be responsible for the supervision and assume joint responsibility for supervision; and the bank will sign a guarantee agreement with the buy-back guarantor enterprise, when the borrower cannot pay loans in full and on time to the bank, the buy-back company will buy-back the collateral WRs at a certain price and based on this, pursue recovery from the borrower.

Fourthly, the rural credit cooperatives will conduct pre-loan investigation, review and approval after accepting the application.

Fifthly, the bank will determine the discount rate based on market value of the cotton and grant short-term working capital loans.

(4) Credit Risk Control

Firstly, to strictly restrict the credit period and collateral rate. In order to prevent price fluctuations and changes in quality of product, it is stipulated that the longest credit period of each WRs collateral loan cannot exceed 8 months; in terms of installment delivery, the maturity date of each loan shall not exceed the date of installment delivery on the Bill of Lading; the maximum collateral rate shall not exceed seventy percent in terms of loans whose credit periods are less than 6 months, and the maximum collateral rate shall not exceed sixty five percent in terms of loans whose credit periods are more than 6 months; and the collateral rate shall not exceed sixty percent in terms of materials with great fluctuations in market price. Meanwhile, the lowest exit price of collateral materials is specified to avoid the risk that the price of collateral materials may fall along with the market price.

Secondly, to strictly handle the "three documents". Each WRs collateral loan is required to have WR, quality inspection certificate and insurance policy. The WRs shall be jointly signed between the keeper from the warehousing company and the supervisor from the credit cooperative; quality inspection must be performed by the nationally recognized inspection authorities; and the insurance type shall be property insurance, except losses caused by irresistible natural disasters, all other losses shall be paid in full by the insurance company, and the first beneficiary shall be the Credit Cooperatives Union. Furthermore, insurance against theft shall be added in terms of outdoor storage. Meanwhile, counter-guarantee measures shall be added to require the borrowing enterprises or individuals to increase security of guaranty or the warehousing company shall provide security of guarantee.

Thirdly, to strictly sign a "quadripartite agreement". During the specific operations of WRs collateral loan, after the credit cooperatives obtaining the "three documents", the loans will be granted when the "quadripartite agreement" is signed between the credit cooperatives and pledger, custodian and guarantor.

Fourthly, to strictly conduct inspection and supervision. Based on the establishment of enterprise loan officer system, the credit cooperatives shall inspect the collateral storage materials and management of these materials at least once a month, the credit management department of Credit Cooperatives Union shall carry out the special inspection at least once a quarter, and the audit department of Credit Cooperatives Union shall carry out the special audit at least once a year to ensure that the potential risks can be exposed and rectified in a timely manner.

Case Analysis and Research Hypothesis

In the above case, cause the failing of the cotton market, a large amount of cotton was kept long in stock. Dongying City has launched the financing loans with cotton WRs as the collater-

al. In three years from 2004 to 2007, cumulative loans of 610 million CNY have been granted for 127 cotton enterprises and individuals, and interest income of 25 million CNY has been realized. During the year from 2009 to 2010, Jizhou Rural Credit Cooperatives Union has handled 147 transactions of WRs collateral in total for 63 cotton enterprises, with a total amount of 108.33 million CNY. There is no risk loan among the total 147 transactions, and both the recovery rate and interest rate are a hundred percent. Based on these facts, we propose the following hypothesizes:

H1: when the trading market of WRs is imperfect, WRs collateral is still able to help relieve the credit constraints;

So, what is the key factor for the WRs collateral to relieve the credit constraints? The above case shows that, although cotton WRs collateral can form a signal and to some extent alleviate the asymmetric information in credit market, the market for the circulation of cotton WRs is imperfect and the systematic rules of WRs collateral have not been established either, furthermore, cotton WRs collateral itself will bring a problem of asymmetric information on the market, such as cotton quality, logistics, warehousing and transportation, market price and sales channels etc. Certainly, banks will obtain this information by themselves from the cotton market to alleviate the problem of asymmetric information on the market, however, the banks are not professional in the cotton market, and thus it will be costly for them to obtain this information, therefore, they will be confronted with adverse selection, moral hazard, supervision cost and other problems in the cotton market. If these problems cannot be solved, the banks are still confronted with significant credit risks, the credit constraints on cotton and cotton purchasing and processing enterprises cannot be solved fundamentally.

So, how to solve these problems in the above case? The case shows that, during the WRs financing, the bank has respectively established a joint liability agreement for purchasing with the cotton purchasing enterprise and a joint liability agreement for supervision with the logistics and warehousing company, and this is the key to the problem, that is the bank has introduced joint liability mechanism into the WRs financing. Why? Since once the joint liability mechanism has been introduced, it will stimulate

agents to use their private information to serve the banks, and thus alleviate the problem of asymmetric information between banks and borrowers. As (Santarosa 2015) argued that establishing a joint liability team is a key innovation in overcoming adverse selection, moral hazard, lack of guarantee and other problems. In a similar way, when the market for the circulation of WRs is imperfect and the systematic collateral rules have not been established either, if the joint liability mechanism is introduced into the WRs financing, the private information of agents will be used for pre-loan screening, in-loan supervision and after-loan constraint, and even a part of costs and risks will be transferred. Based on the above-mentioned reasons, we propose the following hypothesizes:

H2: when the trading market of WRs is imperfect, it will help relieve the credit constraints to carry out WRs financing by introducing joint liabilities for supervision.

H3: when the trading market of WRs is imperfect, it will help relieve the credit constraints to carry out WRs financing by introducing joint liabilities for purchasing.

MEDTHODOLOGY

Research Design:
A Field Experimental Research

Research Conditions

In order to better measure the effects of WRs collateral to alleviate the credit constraints on rural households under different joint liability, the same financing situation is set up during the research.

According to the scale of land rented by household and assuming that the sales go well by the end of the year, then the household can obtain sales revenue of 100,000 CNY. Assuming that the household has no collateral and there is no professional guarantee agency to provide guarantee for him, if he apply for short-term working capital loans of 80,000 CNY from bank and was rejected by the bank, the loan he obtained is 0.

Then, assuming that the household continue and try to re-apply for loans through the following two ways:

(1) Apply for Credit Rating Loans.

That is, through the traditional channels of credit rating, and if the credit rating of the house-

hold was appraised as A, he can apply for the pure credit loans.

(2) Apply for Supply Chain Financing that is Based on the WRs Collateral

That is, after the household receiving grain order from downstream trading partners of the supply chain (such as leading enterprises in agriculture and government grain purchasing departments etc.), the commercial bank and other financial institutions will provide a certain amount of closed financing to the household after assessing the value of the order and its corresponding risks.

Research Object

The objects of research are loan officers from commercial banks.

Research Variables and Research Process

In accordance with different joint liability agreements signed between the bank and the agent, loan officers are divided into two experimental groups:

The first group of banks will sign a joint liability agreement for purchasing with the logistics company, that is, during the financing process, the warehousing and logistics company in the supply chain will be required to assume the supervision responsibility for materials covered in the WRs to ensure that the agricultural products will be well preserved and kept intact during the supervision period;

The second group of banks will sign a joint liability agreement for purchasing with the purchasing company, that is, if the household fails to perform the agreement and make the payment on time, the purchasing company is clearly held liable for purchasing the agricultural products covered in the WRs at a certain price.

As stated above, the responses of two different subjects were tested under two financing modes of credit rating loans and grain order fi-

nancing. Table 1 shows the design of the experiment and the experimental responses (results). Wherein each row in the Table corresponds to an experiment; and each column corresponds to the parameter value, and there is one parameter L in total and two values will be taken. In order to reflect all the combinations of each value of each parameter, two experiments are needed.

(2) Variables Explanation and Measurement

A. Pre-measurement Y

The observation indicator of pre-measurement Y is credit line Y'n, and the content to be measured is the amount of loans that the bank is willing to lend to rural households.

B. Post-measurement Y'

The observation indicators of post-measurement Y' is credit line Y'n, the content to be measured is the amount of loans that the bank is willing to lend to rural households.

RESULTS AND DISCUSSION

WRs Financing and Household's Credit Rationing

In order to reflect the impact of WRs collateral on the credit constraints on rural households, we has conducted a t-test with paired samples on the credit line difference under two loan modes of credit rating loans and WRs financing, and the test results are as shown in Tables 2 and 3.

According to data analysis of the test results, the average credit line granted for a household with a gross sales income of 100,000 CNY is 32,640 CNY through credit rating loan, and the average credit line granted for the household is 74,651 CNY through WRs collateral. The average difference between the two credit lines is 42,012 CNY. That is, based on the supply chain financing model of guaranteed credit, the average credit line granted for a household with a gross sales income of 100,000 CNY is 42,012 CNY more than the credit line granted through pure

Table 1: WRs financing and design of the experiment

Group	Pre-measurement Y (Credit Rating Loan)	Independent variable (L)	Post-measurement Y' (WRs Financing)
Experimental Group 1	Y1	Joint liability for purchasing (L+)	Y1'
Experimental Group 2	Y2	Joint liability for supervision (L-)	Y2'

credit loans. The paired samples t-test results show that the significance probability of two-sided t-test is 0.000 which is less than 0.001. It means that, compared to the traditional credit rating loan, the credit line granted for the borrowers has been increased significantly under the WRs financing.

Assuming that the profit rate in growing cotton is fifteen percent then the operating costs need to be invested in the production process is 85,000 CNY. Since rural households have paid the land lease payments in advance, there is no fund remained to be invested in the production and operation and there will be a lack of working capital of 85,000 CNY. According to the results from the above statistics: the degree to relieve credit constraints on rural households is 38.4 percent under the mode of credit rating loans, and the degree to relieve credit constraints on rural households is 87.82 percent under the mode of WRs financing. The research find a significant impact on the relief of credit constraints in household by introducing WRs Financing with joint-liability. A simultaneously introduced credit rating loans with individual-liability delivers no significant impacts. So there are significant difference in solving household financing difficulties between both types of microcredit, because the WRs Financing with joint-liability in supply chain expanded beyond the reach of an individual's personal networks.

Joint Liability and Household's Credit Rationing

As stated above, joint liability mechanism is the key to the success of WRs financing when the market for the circulation of WRs is imperfect. There are two kinds of joint liability mechanisms in WRs financing:

The first one is joint liability for supervision, that is, a joint liability agreement for supervision will be signed between the bank and the logistics and warehousing company to ensure that agricultural covered in the WRs will be well preserved and kept intact during the collateral period.

The second one is joint liability for purchasing, that is, a guarantee agreement for purchasing will be signed between the bank and the purchasing company to ensure that agricultural covered in the WRs will be purchased by the purchasing company at a certain price when the rural households fail to make the payment on time.

In order to clarify the impact of different joint liabilities on the credit constraints on rural households and the credit risk of bank under WRs financing, researcher has conducted a T-test with paired samples on differences in the credit constraints on rural households and the credit risk of bank under different joint liabilities of WRs financing.

The researchers have conducted a t-test with independent samples on the differences in credit lines of WRs collateral under different joint liabilities. The test results are as follows:

Table 4 is a simple statistical description of changes in credit lines of WRs collateral under different joint liabilities. N is the number of observed quantities, respectively representing that the number of observed samples of "solely assuming joint liability for purchasing" is 40, and the number of observed samples of "solely assuming joint liability for supervision" is 46. Mean

Table 2: A simple statistical description of relief degree on credit constraints under the modes of credit rating loans and WRs financing

	Average credit line	Credit constraints relief	Number of samples	Standard deviation	Standard error of the mean
Credit Rating Loans	3.2640	38.4%	86	4.4670	.4817
WRs Financing	7.4651	87.82%	86	6.8817	.7421

Table 3: Paired samples t-test of credit line difference between credit rating loans and WRs financing

	Paired differences					T	Df	Significance level (two-sided)
	Average credit line difference	Standard deviation	Standard error of the mean	95% confidence interval difference				
				High	Low			
Credit Rating Loans –WRs Financing	-4.2012	5.7734	.6226	-5.4390	-2.9634	-6.748	85	.000

Table 4: A simple statistical description of changes in credit lines of WRs financing under different joint liabilities

	Model subdivision 2	Number of samples	Mean	Standard deviation	Standard error of the mean
Difference in	Joint liability for Purchasing	40	6.5375	6.76851	1.07019
Credit Lines	Joint liability for Supervision	46	2.1696	3.76628	.55531

refers to the average increases in credit lines of WRs collateral under joint liability mechanism compared to the credit rating loans, in the case of solely assuming joint liability for purchasing, the average increase in the credit line is 65,375 CNY; and in the case of solely assuming joint liability for supervision, the average increase in the credit line is 21,696 CNY.

Table 5 is a t-test with independent sample on changes in credit lines of WRs financing under different joint liabilities. The Table shows that F=1.775 and significant probability p= 0. 186>0.001 from the results of Variance Homogeneity Test, therefore, it is concluded that there is no significant difference between two groups of variances, and data from the column of assuming variance is equal shall be selected as the results of t-test.

The significant probability of two-tailed t-test 0.000<0.05, it is concluded that difference in credit lines of WRs Financing under two different joint liabilities is significant. The difference between the two means is 4.3679, that is, under the WRs financing model, an additional loan of 43,679 CNY will be obtained under solely assuming joint liability for purchasing than the loans obtained under solely assuming joint liability for supervision.

The research finds a significant impact on the relief of credit constraints in household by intro-

ducing WRs financing with joint-liability for purchasing. A simultaneously introduced WRs Financing with joint-liability for supervision delivers no significant impacts. So there are significant differences in solving household financing difficulties between both types of joint liability.

The paper presents results from experiment in rural China where WRs financing and credit rating loans were randomly introduced across ten villages. There are also other researches about the microcredit in similar situation in other countries, such as Credit Rationing and Family Networks (Bouquet et al. 2015). However, the key for reducing the risk and pressure of microcredit is joint liability (Attanasio et al. 2015) and the optimal allocation of alternative collateral assets (Niinimäki and Pekka 2015), which is proved in others' research and this paper by data analysis.

CONCLUSION

The aim of this paper was to measure and compare the effectiveness of these two types of microcredit in mitigating household financing difficulties.

One of the findings is that WRs financing can significantly reduce the credit risks of the bank, significantly improve the credit lines grant-

Table 5: t-test with independent samples on changes in credit lines of WRs financing under different joint liabilities

		Variance homogeneity test (Levene Test)				Mean homogeneity t-test				
		F value	Significance level	T value	Degree of freedom	Significance level (two-sided)	Mean difference	Difference in standard deviation	95% confidence interval difference High	Low
Credit Line INC	Assuming variance is equal	1.775	.186	3.760	84	.000	4.3679	1.1616	2.0580	6.6779
	Assuming variance is unequal			3.623	59.114	.001	4.3679	1.2057	1.9555	6.7804

ed for rural households and relieve the credit constraints on rural households. It means that when the rural credit market is imperfect, WRs collateral can reduce the credit risks of bank and help relieve the credit constraints on rural households.

Importantly, the paper finds that the introduction of joint liability in supply chain, which is joint liability for purchasing and joint liability for supervision, is the key factor to reduce the credit risks of bank and help relieve the credit constraints on rural households. Since compared to the credit rating loan model, carrying out WRs financing after the introduction of Joint liability mechanism can significantly reduce the credit risks of the bank and relieve the credit constraints on the rural households. Therefore, when the rural credit market is imperfect, joint liability mechanism is the key factor to the success of WRs financing.

When carrying out WRs financing, there are both differences and common factors in terms of effect of different joint liability mechanisms on credit constraints of rural households.

First, in terms of credit lines granted for rural households, there are significant differences between the two different joint liability mechanisms, that is joint liability for purchasing and joint liability for supervision. Specifically speaking: in terms of WRs financing, there is significant increase in credit line obtained through solely assuming joint liability for purchasing compared to the credit line obtained through solely assuming joint liability for supervision.

Second, there is no significant difference in terms of credit risks of the bank between the two different joint liability mechanisms when carrying out WRs financing.

The difference in the credit constraints on rural households between two different joint liability mechanisms indicates that both joint liability for purchasing and joint liability for supervision are key factors for the bank to control its credit risks, and joint liability for purchasing is the key factor to improve the credit line from the bank.

An important question is why microcredit in supply chain may have been more effective at mitigating household financing difficulties in the context. The main factor is the introduction of joint liability mechanisms for supply chain trading partners and other non-market mechanisms, so that the joint-liability in microcredit in supply chain expanded beyond the reach of an individual's personal networks. It can be said that, when the rural credit market is imperfect, the introduction of joint liability mechanisms for trading partners and other non-market mechanisms can effectively fill up the deficiency in the development of market mechanism, solve the failure in the rural credit market and relieve the credit constraints on rural households.

RECOMMENDATIONS

According to the study above, the way of microcredit is vital in mitigating household financing difficulties. When establishing the microcredit system for rural area, the joint liability mechanisms and other non-market mechanisms should be founded first, and the proper collateral should be chosen and the to balance the liability and relieve the credit constraints on rural households.

ACKNOWLEDGMENT

REFERENCES

Amzat J, Olutayo OA 2009. Nigeria, capitalism and the question of equity. *Anthropologist*, 11: 239-246.

Attanasio O, Augsburg B, Haas DR, Fitzsimons E, Harmgart H 2015. The impacts of microfinance: Evidence from joint-liability lending in Mongolia. *American Economic Journal: Applied Economics*, 7: 90-122.

Bouquet E, Morvantroux S, Rodriguezsolis G 2015. Agricultural workers, credit rationing and family networks in rural Mexico. *The Journal of Development Studies,* 51:1-15.

Cheng Enjiang, Abdullahi DA 2014. The demand for credit, credit rationing and the role of microfinance: Evidence from poor rural counties of China. *China Agricultural Economic Review,* 6: 295-315.

Coco G 1999. Collateral, heterogeneity in risk attitude and the credit market equilibrium. *European Economic Review,* 43: 559-574.

Conning J, Udry C 2007. Rural financial markets in developing countries. *Handbook of Agricultural Economics,* 3: 2857-2908.

Coulter J, Onumah G 2002. The role of warehouse receipt systems in enhanced commodity marketing and rural livelihoods in Africa. *Food Policy,* 27: 319-337.

Gani BS, Adeoti AI 2011. Analysis of market participation and rural poverty among farmers in northern part of Taraba State, Nigeria. *Journal of Economics*, 2: 23-36.

Guo Z, Zhang J 2010. Dynamic Control for the Risk of Value in the Loans of Warehouse Receipt Collateral Based on CVAR. *Proceedings of the 2010 International Conference of Logistics Engineering and Management* in Lanzhou, China, September 15-16, 2010.

Li Cui, Yong Sheng Zhou, Mingke He, Hao Zhang, Shu Pang 2012. Customer Credit Risk Assessment of Pledge by Warehouse Receipts in a Chinese Logistics Enterprise. *5th International Conference on Business Intelligence and Financial Engineering* in Chengdu, China, October 8-10, 2010.

Li R, Li Q, Huang S, Zhu X 2013. The credit rationing of Chinese rural households and its welfare loss: An investigation based on panel data. *China Economic Review*, 26: 17-27.

Ma H, Qiu X 2008. An Analysis Method of the Loan-Pledge-Rate of Warehouse Receipts Pledge Using VAR. *Proceedings of the 8th International Conference of Chinese Logistics and Transportation Professionals* in Chengdu, China, October 8-10, 2008.

Niinimäki Juha Pekka 2015. The optimal allocation of alternative collateral assets between different loans. *The North American Journal of Economics and Finance,* 34: 22-41.

Rangasamy N 2013. Economic performance of warehousing service, constraints faced by agri-warehouses in Maharashtra and scope for negotiable warehouse receipts credit in India. *Indian Journal of Marketing,* 43: 5-11.

Santarosa VA 2015. Financing long-distance trade: The joint liability rule and bills of exchange in eighteenth-century France. *The Journal of Economic History,* 75: 690-719.

Varangis P, Larson D 1996. How warehouse receipts help commodity trading and financing. *DEC Notes: Development Trends,* 21: 123-130.

Xiao MD, Zhang DY 2013. A theoretical model design for third party logistics selection in warehouse receipt system using unascertained mathematics. *Journal of Applied Sciences*, 21: 4839-4844.