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The Comparative Analysis of Models for Forestry Asset Securitization

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Abstract: The securitization of forestry asset can effectively solve the problem that woodlands always be fragmentation and need long-cycle. However, different modes have different efficiency. This paper divided the four modes for the securitization of forestry asset from the World Bank research report for forestry bond into two categories: the direct securitization of forestry asset and the securitization of forestry loans. This paper gave model simulation and analysis to both of the securitization modes, then concluded the direct securitization of forestry asset finances more efficiently than the securitization of forestry loans when construction cost can be ignored; the efficiency of the two financing depends on the scale of financing when construction cost added.

Key words: Forestry asset securitization, financing efficiency, comparative analysis

INTRODUCTION

Asset securitization, the most important financial innovations in recent decades, has applied into the forestry sector. Since the late 1990 sec forestry, REITs have gradually risen in the United States (Petley *et al.*, 2007). Not only has America's forestry resources asset securitization been successful, but also the developed countries in Europe such as Finland and Switzerland and developing countries like Chile and Brazil have achieved some success (New Forst Advisory Pty Limited, 2011). For example, in Finland, "Stora Enso Oyj full-service forestry asset securitization" is the world's first full-service forestry asset securitization (Peltola and Makinen, 2003). Argentina's "Lignum forestry fund securitization" has become the world's first operation to realize forestry asset securitization through the forestry fund (Boscolo *et al.*, 2010). These practices provide a strong support for solving the plight of forestry finance.

Forest-backed Bonds Proof of Concept Study (2007) published by IFC indicated that the securitization of forestry assets has a promising prospect and a strong appeal to investors. According to the cash flow's characteristics of forestry assets, " Forest-backed Bonds Proof of Concept Study " proposed four models for securitization of forestry asset: the bond of the government's forestry revenue (Jones, 2012), the bond of the forestry supported by trade (Wood and Grace, 2011), the bond of supported by forestry loans and the zero coupon bond (Petley *et al.*, 2007). Although, the above four models have different structures, the four models can be divided into two categories based on the criterion that

whether the bank participates in the operation or not. One is the direct securitization of forestry asset and the other one is the securitization of forestry loans. This study concentrates on the establishment and the comparison of the two financing models of securitization. After analyzing the differences in financing costs and financing efficiency, this study will choose the model which has an advantage in efficiency and provide a feasible path for securitization forestry asset in the future.

DEFINITION OF SECURITIZATION OF FORESTRY ASSET

The securitization of forestry asset's essence is to apply asset securitization into forest resources. Therefore, the definition of the securitization of forestry asset can be derived from the definition of asset securitization (Cranford *et al.*, 2012). The definition of the traditional asset securitization: securitization is the process of pooling various types of debt-mortgages, car loans, or credit card debt, for example- and packaging that debt as bonds, pass-through securities, or Collateralized Mortgage Obligations (CMOs), which are sold to investors (Bhattacharya and Fabozzi, 1996). In the definition of the traditional asset securitization, real sales, the isolated risk and the credit enhancement are the significant characteristics. However, with the emergence of the innovation of securitization model such as the whole business securitization, asset securitization has broken through the traditional characteristics and has become more flexible. Thus, asset securitization can be defined with a broader context: The assets which lack of

liquidity shift to tradable bonds. Under this definition, securitization of forestry asset can be derivative as: The forestry resources which lack of liquidity shift to the tradable bonds.

PROSPECT OF SECURITIZATION OF FORESTRY ASSET IN CHINA

The present financing model of forestry in China is relatively backward. The main source of funding still comes from financial subsidies and forestry loans so that it is difficult to attract a large number of social investment to support the development of forestry. Under the background that traditional financing can hardly solve forestry investment's barriers, the innovation of forestry is quite urgent. Asset securitization as the most important financial innovation in recent decades brings high liquidity and risk diversification, which can effectively solve the problem that forestry investment cycle is too lengthy and highly risky. Therefore, asset securitization in the field of forestry has a broad application prospect in China.

At present, China faces a significant opportunity to develop asset securitization. On the one hand, after decades of reform and opening up, the national capital market has begun to take shape. Institutional investors are growing their power and many individual investors holding a large amount of capital are emerging. The individual investors can provide a valuable source of funds for asset securitization; On the other hand, China's forestry system has huge potential to create more wealth. With an average of only 3,000 yuan per hectare value, China's forest quality is relatively poor now. However, if these forests can be operated scientifically, in a few decades the standing trees will have a total value worthing 160 trillion yuan. Thus the potential value of forests laid the foundation for the implementation of securitization of forestry asset in China. At last, China's collective forest tenure reform has been basically completed. The clear forest rights create a condition for defining the forest resources which may be involved in the securitization of forestry asset.

METHOD SELECTION

Foreign scholars' researches about asset securitization focus on the comparison between the financing efficiency of bank's deposits and financing efficiency of securitization of bank's credit asset. Although the goal of these studies to compare finance efficiency is different from the goal of this study, methods

applied in these studies can be a great reference for this study. The methods are generally divided into two categories: The first method belongs to the theoretical analysis based on building the model. Some researchers simulated capital market and credit market environment through mathematical models and compared models in order to make a decision for financing method, such as (Greenbaum and Thakor (1987), Gorton and Pennacchi (1995) and DeMarzo (2005). This kind of method belongs to the pre-assessment on the theoretical level. The second method, (Cebenoyan and Strahan, 2004; Loutschina and Strahan, 2009; Hirtle and Stroh, 2007), analyzed time series data of securitization transactions of credit asset and then evaluated financing efficiency of securitization. After that, compare the financing efficiency of securitization with the financing efficiency of bank's deposits, finally make a decision for bank's financing. This method belongs to post-assessment on the empirical level. Since China's market for securitization of forestry asset has not yet been established, there is lack of actual data to support the research. This study will utilize the model base on theoretical analysis which compares the financing efficiency of direct securitization of forestry asset with the financing efficiency of securitization of forestry loans. This pre-assessment on the theoretical level can provide an access to future application.

MODEL OF DIRECT SECURITIZATION OF FORESTRY ASSET

Assumptions of the model: The securitization of forest asset is not only involved in the securities market but also involved in the credit markets. The participants in the transaction include management bodies of forestry, investors and banks. The subordinated bodies are service providers, trustees, credit rating agencies, credit enhancement institutions and securities underwriters. The structure and procedure of the transaction is complex. In order to simulate and simplify the transaction environment, the following assumptions are made to build the model:

- **Assumption 1:** In the transaction, there are three kinds of participants: Promoters, investors and banks (promoters), promoters and banks are risk-neutral and investors are risk-averse
- **Assumption 2:** Each promoter invests one Yuan which borrowed from the bank to a single-term project. With the probability δ , the revenue of a promoter is R Yuan. With the probability $1-\delta$, the revenue is 0. The probability δ belongs to the

interval $[\delta_1, \delta_2] \subseteq [0, 1]$. The probability δ is the promoters' private information and the revenue R is public information. The cost to eliminate information asymmetry is ignored

- **Assumption 3:** The credit market for banks is a perfectly competitive market. The goal of securitization of banks' asset is to maximize promoters' revenue
- **Assumption 4:** The amount of the bank's own fund is K . The bank invests the fund into risk-free investments. The capital market's risk-free interest rate is R_f . Part of the fund $\theta^*(\delta)$ which comes from the bank's loan will be used for the credit enhancement of the securities in order to compensate investors if promoters' investment fails. Other costs in securitization mode are temporarily ignored
- **Assumption 5:** Investors' requirements for revenue depend on their expectation for promoters' success rate δ and the degree of credit enhancement
- **Assumption 6:** Investors' expected utility function is $U(\chi)$ and investors' minimum expected revenue in the securitization market is $\bar{\mu}$

The model of direct securitization of forestry asset: According to the above assumptions, the model of the direct securitization of forestry asset is derived:

$$\max \{ \delta [R - r(\delta, \theta^*(\delta))] - (1 - \delta) \theta^*(\delta) r(\delta, \theta^*(\delta)) \} R_f^{-1} \quad (1)$$

The restrictions are shown in Eq. 2, 3 and 4:

$$\delta U(r(\delta, \theta^*(\delta))) + (1 - \delta) U(\theta^*(\delta) r(\delta, \theta^*(\delta))) \geq \bar{\mu} \quad (2)$$

$$\theta^*(\delta) \in \arg \max_{\theta \in [0, \lambda(\delta)]} \{ \delta [R - r(\delta, \theta)] R_f^{-1} - (1 - \delta) \theta r(\delta, \theta) \} \quad (3)$$

$$\lambda(\delta) \equiv R_f [r(\delta, \theta(\delta))]^{-1} \quad (4)$$

In the model, Eq. 1 shows that the promoters's goal is to maximize their own revenue. At the same time it needs to meet the following conditions: Firstly, Eq. 2 shows investors' minimum expected revenue utility can be satisfied; secondly, Eq. 3 shows that the promoters maximize their revenue through choosing the degree of credit enhancement $\theta^*(\delta)$ Eq. 4 is the constraint of definition

The model of securitization of forestry loans: According to the above assumptions, the model of securitization of forestry loans is derived:

$$\max \{ \delta [R - \xi(\delta, \theta^*(\delta))] - r(\delta, \theta^*(\delta)) \} R_f^{-1} \quad (5)$$

The restrictions are shown in Eq. 6, 7, 8 and 9:

$$\delta U(r(\delta, \theta^*(\delta))) + (1 - \delta) U(\theta^*(\delta) r(\delta, \theta^*(\delta))) \geq \bar{\mu} \quad (6)$$

$$\theta^*(\delta) \in \arg \max_{\theta \in [0, \lambda(\delta)]} \delta [R - \xi(\delta, \theta) - r(\delta, \theta)] R_f^{-1} \quad (7)$$

$$\delta [(\xi(\delta, \theta^*(\delta)) + KR_f) + [1 - \delta] [KR_f - \theta^*(\delta) r(\delta, \theta^*(\delta))] \geq KR_f \quad (8)$$

$$\lambda(\delta) \equiv KR_f [r(\delta, \theta(\delta))]^{-1} \quad (9)$$

In the model, Eq. 5 shows that the goal of banks' securitization is to maximize the promoters' revenue. It also needs to meet the following conditions: firstly, Eq. 6 shows that investors can meet the minimum expected return utility; secondly, Eq. 7 shows that the banks maximize receivers' revenue through choosing the degree of credit enhancement $\theta^*(\delta)$; thirdly, Eq. 8 shows that banks' revenue is greater than the revenue of risk-free capital; Eq. 9 is the constraint of definition.

COMPARISON AND ANALYSIS BETWEEN THE TWO MODELS

Comparison of financing efficiency of a single transaction: Directly compare the model of direct securitization of forestry asset and the model of securitization of forestry loans and then analyze the two models' financing efficiency of a single transaction.

Both of Eq. 1 and 5 multiple R_f . Then, the difference of the two equations is derived:

$$\delta \xi(\delta, \theta^* \delta) - (1 - \delta) \theta^*(\delta) r(\delta, \theta^*(\delta)) \quad (10)$$

Simplify the Eq. 8:

$$\delta \xi(\delta, \theta^* \delta) - (1 - \delta) \theta^*(\delta) r(\delta, \theta^*(\delta)) \geq 0 \quad (11)$$

Put the Eq. 11 into the Eq. 10. It can be proved that Eq. 10 is greater than 0. The Eq. 10 is the difference of the two objective equations. The objective function represents the revenue of promoters, which illustrates that the promoters of direct securitization of forestry asset gain a greater revenue. At the same time, the restrictions of direct securitization of forestry asset are more strict than those of securitization of forestry loans. Thus, in a single transaction, financing efficiency of direct securitization of forestry asset is higher than that of securitization of forestry loans.

Add the cost of financing efficiency into the comparison:

When this study builds the models, one important assumption is that except credit enhancement fees, the building costs of securitization are ignored. In reality, this assumption is clearly unrealistic. The process of securitization involves multiple auxiliary institutions, which produce a number of building costs. These building costs are generally considered being weakened by the large scale of financing. Still, we consider these costs into the analysis.

Assume that if financing 1 yuan, the building cost of direct securitization of promoters and indirect securitization of banks are C_n and C_h . C_h is a fixed value and C_n has a capital scale effect, namely that the promoters' build cost change the same proportion with the scale of financing: $C_n = \omega K_n$. ω is the variation coefficient.

Put C_n and C_h into Eq. 1:

$$\max \{ \delta [R - r(\delta, \theta^*(\delta)) - C_n] - (1 - \delta) \theta^*(\delta) r(\delta, \theta^*(\delta)) + C_n \} \geq R_f^{-1} \quad (12)$$

Equation 10 changes into:

$$\delta \xi(\delta, \theta^*(\delta)) - (1 - \delta) \theta^*(\delta) r(\delta, \theta^*(\delta)) - C_n \quad (13)$$

Put C_n and C_h into Eq. 8:

$$\delta [\xi(\delta, \theta^*(\delta)) + KR_f] + [1 - \delta] [KR_f - \theta^*(\delta) r(\delta, \theta^*(\delta))] \geq KR_f + C_b \quad (14)$$

Equation 14 can be simplified as:

$$\delta \xi(\delta, \theta^*(\delta)) - (1 - \delta) \theta^*(\delta) r(\delta, \theta^*(\delta)) \geq C_b \quad (15)$$

Put Eq. 15 into the Eq. 13:

$$\delta \xi(\delta, \theta^*(\delta)) - (1 - \delta) \theta^*(\delta) r(\delta, \theta^*(\delta)) - C_n \geq C_b - C_n \quad (16)$$

Equation 16 is the difference between the model of direct securitization of forestry asset and the model of securitization of forestry loans after adding the build costs. The difference between the lower limit is $C_n - C_h$. Only when $C_n - C_h \geq 0$, can we obtain the difference of objective function is greater than 0. Because building costs of direct securitization of forestry asset has a scale effect $C_n = \omega K_n$, we can only use ωK_n to replace C_n . Only when $K_n \geq C_n / \omega$, can we obtain the difference of objective function is greater than 0. Therefore it can be drawn that only when the promoters have a large scale of financing, can the financing efficiency of direct securitization of

forestry asset has advantages. In contrast, if the promoters have a small scale of financing, securitization of forestry loans is more efficient.

CONCLUSION AND POLICY RECOMMENDATIONS

Through simplifying the transaction environment, this study established the model of direct securitization of forestry asset and the model of securitization of forestry loans. After that it analyzed the differences in financing efficiency between the direct securitization of forestry asset and the securitization of forestry loans. The results are presented.

Firstly, on the condition that building costs are ignored except the cost of credit enhancement, the financing efficiency of direct securitization of forestry asset is higher than that of securitization of forestry loans. The reason may lie in that the increased transaction links undermine the revenue of promoters.

Secondly, after adding build cost into the analysis, financing scale is the key factor to decide which model has a higher financing efficiency. If the financing scale is large enough, the financing efficiency of direct securitization of forestry asset is higher than securitization of forestry loans. On the contrary, If the financing scale is small, the financing efficiency of securitization of forestry loans is higher than that of direct securitization of forestry asset.

Thirdly, as for forestry, the choice of the two models depends on average financing scale of the promoters. Under current conditions, there are a few large entities that run forestry business. More involved in forestry business are natural persons with small financing scale. Thus, the financing efficiency of securitization of forestry loans is higher than that of direct securitization of forestry asset. However, in the long run, to gather forestry assets on the large scale is the inevitable way to develop forestry. Therefore, the direct securitization of forestry asset still has broad prospects for application in China.

In light of above conclusions, when China makes a strategy for the development of forestry it can firstly develop the securitization of forestry loans. However, in the long term, with the prosperity of forestry transaction based on forestry rights and the gathering of forestry assets on the large scale, China should focus on the development of direct securitization of forestry asset. Ultimately, China can get rid of the plight of forestry financing by relying on direct securitization of forestry asset.

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