# Agricultural Productions, Credit Constraints, and Rate Liberalization in China

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**Abstract:**
The interest rate liberalization is the most important stage for China's financial reform. The shock from interest rate liberalization to China's real economy will directly affect the timing and path of policies launched by the central government during the reform process. In order to explore the changes in China's industrial sectors, especially changes in China's agriculture production, this paper constructs a two-sector dynamic stochastic general equilibrium (DSGE) model with heterogeneous credit constraint. We find that rise in nominal interest rate would lead to obvious output decrease in industrial/manufacturing sector. Each percent increase in interest rate renders 1% drop in industrial production. Due to the arable land red line control, output decline in the agricultural sector is moderate; thereby the proportion of agricultural output would slightly rebound.

      **Key words**：Interest rate liberalization; DSGE model; Industrial structure; Heterogeneous Credit Constraint

      **JEL Classification**：E31，E51

Released from interest rate control to interest rate liberalization could be considered as a significant symbol that a country's financial system is turning to mature. China's interest rate reform has gone through multiple stages, namely, the interbank lending market interest rate liberalization, the bond market interest rate liberalization, the lending interest rate floor loosening etc. The slow progress of the reform process is out of abundance of caution by the policy makers and the decision-making bodies, as it's difficult for them to fully and accurately measure the pros and cons of such reform. In the second half of 2015, China's central bank lowered the deposit interest rate for commercial banks and no longer set the deposit interest rate floating-cap for rural cooperative financial institutions. Till then, China's market-oriented interest rate reform that lasted two decades has been almost completed. Whether the interest rate market should be open is no longer the center of discussion. We should pay more attention to what impact such great change would bring to the capital allocation of Chinese market, as well as the future of China's economic structure.

Referring to the worldwide experience, market-oriented interest rate reform will lead to changes in a country's interest rate, and thus promote the industrial restructuring. According to World Bank statistics, out of the 18 countries that implemented a market-oriented interest rate reform, 17 countries experienced a rise in real interest rate (Songcheng Sheng, 2013) and continuous outflow of capital and labor from the primary industry to the secondary and tertiary industry. Will a similar condition happened to China after opening-up the interest rate market? Will the serious problem of "de-ruralization/de-agriculturalization" in China be further deepened? Historically, shrink of the agricultural sector usually accompanies process of modernization. However, over-speeding "de-ruralization/de-agriculturalization" would inevitably lead to structural imbalance in the national economy and a series of social conflicts and concerns. For nearly a decade, with the deepening of China's market-oriented reforms, factors of production keep gathering to China's urban, manufacturing and other profitable sectors, while China's agricultural sector keep shrinking with large outflows of capital and labor. The "de-ruralization/de-agriculturalization" tendency is more and more prominent in China. At the same time, China's credit market exists obvious urban-rural-heterogeneity. The agricultural sector is confronted with more severe credit constraints than the industrial sector. Significant differences in access to capital credit lead to disparities in the extent of the shock from interest rate reform to the manufacturing and agricultural sectors. For manufacturing sector, other powerful industries and large state-owned enterprises, even though their financing costs will be increased, the impact on their capital availability/accessibility could be limited, thanks to their relatively high rates of return and their abundant effective-pledge. But for disadvantaged sectors with relatively low rates of return and insufficient effective-pledge, such as agriculture and many small/medium private enterprises, the impact could be dramatic. Such heterogeneity renders the dynamic connections between China's different sectors appear to be more sensitive and sophisticated. Therefore, there's

urgent need for us to rethink the shock and restructuring of China's urban-rural dual economic structure under the market-oriented interest rate reform, so as to serve the government decision-makingand the social stability.

In order to clarify the impact of interest rate liberalization on China's characteristic industrial structure under heterogeneous credit constraints, this paper established a two-sector dynamic stochastic general equilibrium (DSGE) monetary economics model. This model aims to explore how interest rate liberalization affects the industrial structure and capital allocation, as well as how technology development and monetary policy influence the price level and the output of different sectors. Innovative contribution of this paper lies in the following three aspects: Firstly, from the perspective of industrial structure, this paper conducts an in-depth quantitative analysis on the impact of interest rate liberalization with DSGE model. Most existing researches studying the impact of interest rate liberalization on economic structure focus on the aspect of demand structure (Zhongxia Jin,2013; Yanbing Chen,2014 etc.), in stead of analyzing the dynamics of the industrial structure. This paper discovers that credit capital's availability/accessibility and its reallocation after interest rate reform contribute to the changes in China's industrial structure. Secondly, despite that some studies have already incorporated the credit constraint into China's macroeconomic research, the most prominent feature for Chinese credit market-the "urban-rural (or agricultural-industrial) dual heterogeneity was not taken into consideration. This paper, for the first time, introduces the "urban-rural (or agricultural-industrial) dual heterogeneity into the macro-stochastic structural model, thus more clearly depicts what shocks China's "urban-rural (or agricultural-industrial) dual market is undergoing after the interest rate liberalization. Thirdly, assumptions about capital flows and credit constraints of classical western models do not fit for China's reality. Aiming at this point, this paper amended the structural model in line with China's condition. Results of the modified model show that owing to the stringent land transfer/circulation restriction (protection of arable land red line), the interest rate liberalization will have a more significant impact on China's industrial/manufacturing sector instead of China's agricultural sector, even though the agricultural capital/asset owns limited mortgage capacity in credit market. Fourthly, this paper extends the land transfer/circulation restriction model, builds the framework of land capitalization and makes a policy-before-and-after comparison. It is found that after liberalization of land capital, the agricultural sector shall suffer greater shocks from the interest rate market and the proportion of agricultural output may drop sharply. Hence, in the future process of interest rate liberalization and land capitalization, it's necessary to adhere to the red line control and increase the availability/accessibility of agricultural credit, so as to curb the imbalance in industrial structure and the trend of de-ruralization/de-agriculturalization.

Current academic researches on the macroeconomic impacts of the interest rate liberalization are mainly concentrated in the areas of demand structure, yet the impacts on industrial structure are not sufficiently discussed. Besides, the core element that seriously affect China's dual economic structure among the process of China's interest rate liberalization reform-the heterogeneity of credit constraints-is often ignored. For example, Yanbin Chen et al. (2014) using a general equilibrium model with heterogeneity, quantitatively analyzedthe relations between interest rate liberalization, credit constraints and the total demand structure, and found that the interest rate liberalization could improve capital allocation and the overall demand structure. Binkai Chen and Yifu Lin (2012) pointed out that the "heavy industry prioritized development strategy" (in order to promote the development of heavy industry, government drives down interest rates through interest rate control deliberately) would eventually result in the industrial structure imbalance. And Bin Xia (2013) claimed that the left-behind factor price reforms might "facilitate" the monopolistic and resource companies (such as steel, oil and other heavy industries) expanding at a lower cost, thereby squeezing the space of the tertiary industry. In addition, Zhengyan Xiao et al. (2015) constructed a DSGE model containing heterogeneous production sectors, and noted that during the process of interest rate liberalization, the gaps in credit constraints between state-owned enterprises and private enterprises must be gradually eliminatedso as to abate the general economic fluctuations.

Moreover, existing literature on interest rate liberalization and industrial structure mainly followed the logic that interest rate control kept down the cost of capital, thus caused over-development of the secondary industry. They believe that interest rate control distorted the capital distribution between different industries, resulting in imbalance of industrial structure. Such as Feyzioğlu et al. (2009) pointed out that the interest rate liberalization would make capital

tend to flow into sectors that difficult to obtain a loan under interest rate control.

Apart from the mentioned paths, market-oriented interest rate reform could also promote industrial restructuring through increasing the consumption rate of the household sector. According to Chenery's study (1960), the consumption structure is the intrinsic motivation for industrial structure upgrading and adjustment. For this reason, he believed that with the progress of the interest rate liberalization and the increase of household income, increased household consumption would stimulate the development of new industries and services, thereby increasing the proportion of tertiary industry in the national economy. Subsequent empirical studies have confirmed Chenery's option. Lin Yang and Jianwei Li (2002) conducted an empirical analysis with time series data on the relationship between the financial system and the changes of industrial structure in United States, Japan, South Korea and Malaysia. Their results showed that since upgrading of consumption structure required increasing investment in human capital and technology development, improving degree of freedom of the financial system would promote the development of the tertiary industry.

Although the above researchers analyzed the paths that interest rate control impacted industrial structure, these studies failed to apply a quantitative analysis in general equilibrium framework. Thus, robustness and validation of the above conclusions should be questioned. There are some scholars have taken advantaged the Econometric methods to measure the impact of monetary policy on industry structure. Hui Zhang (2013) Bo Yu and Conglai Fan (2014) respectively used SVAR and VAR model to analyze structural effects of the monetary policies on the three major industries. Hui Zhang's (2013) result showed that since the primary industry's interest rate sensitivity degree is lower than the sensitivity of the secondary and the tertiary industry, interest rates increasing would lead to a rise in the proportion of primary industry and a decline in the proportion of the secondary and tertiary industry. On the contrary, Bo Yu and Conglai Fan's (2014) result indicated that the primary industry would react most fiercely to the interest rate policy.

The reason why such two studies came to opposite conclusions is they lost a whole picture of the dynamic economic system when restricted by the perspective of partial equilibrium. Unlike the previous researchers, Junbin Wang and Xinjiang Guo (2011) constructed a DSGE model with sticky prices to analyze the impact of monetary policy on the three major industries. Their results showed that, under the interest rate control, due to the different investment cycles of the three major industries, loose monetary policy would generated liquidity effect, which improved the output proportion the secondary and the tertiary industries in short term. Even though Junbin Wang and Xinjiang Guo's (2011) model had some microeconomic basis, they mainly discussed other types of monetary policy while ignoring the role of interest rate policy. In short, it's necessary to build a DSGE model containing interest rate policy to better analyze the influences of monetary policy on China's industrial structure transformation under dual-credit-constraint.

Financial frictions like credit constraint etc. have been introduced into macro-economic models by the economists even before the financial crisis. Scholars generally believed that credit constraints would amplify the impact of exogenous shocks on the macro-economy and produced a "financial accelerator" effect, thereby enhancing the model's explanatory power to the economic cyclical changes. However, before the financial crisis, financial frictions did not attract enough attention, which made macroeconomics failed to predict the occurrence of the 2008 financial crisis (Qiang Qu, 2012). Learning from this lesson, economists had a profound reflection on the macro-economic modeling. And a growing number of scholars recognized that the economic fluctuations amplification effect of financial frictions, particularly credit constraints, was greater than expected. Therefore, more and more people began to incorporate credit constraint into the DSGE model to improve the explanatory power of the model. In the early credit constraint model (Kiyoki and Moore, 1997) believed that because of the existence of the credit constraint, rise of asset price would increase the value of collateral, thus relaxing credit constraint, and further stimulated business lending; on the contrary, when asset prices fell, the value of collateral decreased, and further led to tightening of credit constraint. Therefore, small asset price shocks were amplified by credit constraints, coming into form of the Credit Cycle, and ultimately applying to the macro-economy. On such basis, Iacoviello (2005) introduced three different individuals and real estate mortgage constraint into the DSGE model. The result indicated that the real estate collateral constraint magnifies the influence of real estate demand shocks, thereby expanding macroeconomic fluctuations. Since then, more and more scholars added real estate into

their DSGE models, and explored the impacts of housing credit constraints on economic cycle and resident welfare (Rubio, 2009; Iacoviello and Neri, 2010; Hirata et al, 2013.).

Although the above studies have incorporated credit constraints and individual heterogeneity in model, their discussions on collateral constraint were restricted to physical capital or housing itself. In fact, as important factor of production, land is gifted with dual nature of production capital and financial capital. Fluctuations in land price bridged the real economy and the financial market, thereby amplifying the impact of economic shocks on the macro-economy. In recent years, many scholars tend to introduce land element as collateral for credit constraints in DSGE models. Liu et al. (2013) established a DSGE model including land mortgage constraint, which well explained the American land prices and investment change in the same direction. Studies indicated that DSGE model with credit constraints could also well explain the land price and unemployment rate change in the opposite direction. It also could magnify the transmission effect of land price fluctuations on labor market, leading to a more severe fluctuation in unemployment rate. In the case of the existence of credit constraint, housing demand fluctuation, which could explain more than 40% of investment variability and more than 30% of production variability, is the main source of US economic cyclical changes.

The above literature considered credit constraint heterogeneity among individual and improved explanatory power of the DSGE model to economic cyclical changes, but rarely concerned the impact of credit constraint on agricultural sector. Given the real condition in China, despite the fact that agricultural sector plays a fundamental role in the economy, its long-term development is limited by credit constraints due to weak risk-resistance capacity of this sector, poor liquidity of the production factors etc. With the progress of interest rate liberalization, how to reduce the adverse effects of credit constraint on the agricultural sector, so as to promote the sustainable development of the agricultural sector will be a theoretically and practically important issue. Among the existing literature, scholars mainly used partial equilibrium model or empirical econometric measurement to study the credit constraint in China's agricultural sector. They usually studied impacts of borrowing constraint with partial equilibrium method from the perspective of agricultural production or farmers living. However, few of them conducted in-depth quantitative analysis of impacts of borrowing constraint on the entire agricultural sector from the macro level. For example, according to Dianjun Wu and Xiaotao Zhang's (2008) empirical research based on a survey of 684 rural households, among the rural households with borrowing needs, more than 10% were unable to get loans; 52% of households were able to receive some loans, but the obtained amount was far less than their actual need. This is because formal financial institutions usually offer more stringent collateral rules and lower mortgage amount. Quansheng Yu and Yahong Zhou (2014) applied an empirical study with the cross-sectional data of Chinese Rural Financial Survey on the household welfare losses due to credit constraint. Their results showed that the average intensity of credit constraints in rural China is 14.4%. And increase in credit-constraint-intensity would lead to a drop in farmers' average production income as well as their non-essential consumption. Kumar et al. (2013) practiced the Average Treatment Effect method to study the impact of credit constraint on Chinese and Indian farmers. Their research concluded that credit constraint not only circumscribed farmers' the production scale, but also severely worsened their human capital accumulation and trapped poor farmers in the "cycle of poverty." Chengming Xu and Jianjun Zhang (2012) tested the existence of "financial accelerator" effect in China's agricultural sector by Markov Regime Switching VAR model. Their empirical analysis indicated that credit constraint renders the credit supply in agricultural sector showing range fluctuation characteristics: during the upward cycle of economy, the agricultural credit supply increased remarkably; during the economic downturn, due to a substantial tightening of credit constraint, credit supply decreased significantly and turned to the tendency of credit rationing. All the above papers discussed the impact of interest rate liberalization from the perspective of partial equilibrium. Therefore, they were hardly able to portray dynamic linkages between macro-variables under the shock from interest rate liberalization.

In summary, author of this paper finds that the domestic and foreign literature about interest rate liberalization, credit constraint and industrial structure exist the following inadequacies: On the one hand, existing general equilibrium models ignored the heterogeneous characteristics of credit constraint under China's dual economic structure; on the other hand, current literature discussing impacts of credit constraint on China's agricultural sector mostly focused on partial equilibrium analysis, but did not fully consider its connection and interaction with the overall

economy. In order to fulfill such inadequacies, this article builds a DSGE model containing two-sector credit constraints. This study targets to analyze the impacts of China's Interest Rate Liberalization Reform under credit constraint on the industries, from the perspective of general equilibrium.

Over the past few years, China's progress of interest rate liberalization continues to accelerate. On one hand, the lending rate floor has been liberalized, financial institutions' deposit rate floating range no longer set limits, and the deposit insurance system has been officially launched; on the other hand, proportion of aggregate financing to the real economy has declined from about 90% in year 2002 to about 60% in year 2015. In the next few years, market-oriented interest rate reform will enter the final crucial period. To this end, social communities must reflect further on interest rate liberalization's impacts on China's real economy, as well as the impacts' transmission mechanism. Although existing literature has recorded tremendous studies about interest rate liberalization's effects on the overall demand structure, researches considering interest rate liberalization's influences on China's industrial structure, especially on the agricultural sector, are still insufficient. Therefore, this paper conducts a quantitative analysis on how interest rate liberalization restructures Chinese Dual Economy by constructing a DSGE model with heterogeneous credit constraint.

Main conclusions of this paper are as follows: Firstly, after the interest rate market-oriented reform, steady rise in interest rate increases the marginal cost of capital, resulting in a significant drop of capital investment in the industrial sector. Meanwhile, transfer/circulation control of the agricultural capital (land) contributing to a moderate decrease of production output in the agricultural sector, thus the proportion of agricultural output out of total output increases slightly. This indicates that under the existing arable land red line control system, interest rate liberalization helps alleviate the structural imbalance and curbs the "de-ruralization/de-agriculturalization" trend to a certain extent. Secondly, once the transfer/circulation control of the agricultural land is released, under the impact of rising interest rates, considerable agricultural capital might outflow; thereby the agricultural sector might acceleratedly shrink. Hence, for a long period of future time, China should continue to adhere to the red line of arable land control. Thirdly, after the interest rate market-oriented reforms, improved land mortgage rates could relax credit constraint in the agricultural sector, hence partially offset the adverse effects brought by steady rise in interest rates. Besides, improved land mortgage rates could also enhance the agricultural sector's resistance capacity for exogenous interest rate shock, as well as the social production level, so as to promote the stable development of the agricultural sector and the macro-economy. Government should adopt appropriate policies to increase the effective mortgage rate of land and meet farmers' reasonable lending need during the process of interest rate liberalization. For example, improve land transfer service systems at county, township and village levels; gradually operate registration trial of loan against land use right; progressively open-up farmland mortgage transaction market; establish rural land information sharing mechanism and risk prevention mechanisms to reduce asymmetric information in land mortgage; attract social capital flowing in as credit supply; introduced credit guarantee corporation etc.

Being a core part of China's financial reform, interest rate liberalization is not an isolated financial market behavior, but a gradual dynamic process that leaves profound impact on China's economic structure. As China's economy steps into the "new normal" phase, we must constantly improve the interest rate system and promote optimal allocation of resources, thereby to create fresh "institutional bonus", and ultimately to accomplish the transformation and upgrading of China's economic structure. Nevertheless, we must also keep a clear mind that imbalanced development still exists in China's economy. Comprehensive consideration over gains and losses should always be given to various industrial sectors, especially vulnerable but important industries like agriculture. Government should pay enough attention to predict strikes that the agricultural sector might suffer during the process of interest rate liberalization. Then promote the restructuring of the agricultural sector and improve its risk-resistance ability, so as to avoid worsening the "de-ruralization/de-agriculturalization" phenomenon in China. This is not only related to China's food security, but also closely linked with the stable and healthy advancement t of China's society and economy.

All in all, through the quantitative analysis of China's interest rate liberalization and Chinese industrial structure change, we could have a more profound and explicit judgment of the market-oriented interest rate reform's effects on China's industrial structure, especially its potential

influences on the agricultural sector. This could also be used as practical theoretical guidance for proposing related agricultural and financial policies. Further discussion of this paper could investigate the policy path and its implications in the progress of continuing interest rate liberalization: Firstly, add individual heterogeneity to the credit constraint model; secondly, introduce the policy path of land capitalization and examine effects of different land capitalization policies on the two sectors and the macroeconomic structure; Thirdly, study the possibility and potential influences of a urban-rural two-track system in the progress of interest rate liberalization.

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