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Chinese Shadow Banking Institutions: Understanding Factors Contributing to the Systemic Risks of Trusts and Investment Corporations

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Shadow Banking Systems

Defining what shadow banking is essentially difficult, as there is no consensus between various experts. For the scope of this research, shadow banking will be defined in IMF's terms, as "all financial activities, except traditional banking, which require a private or public backstop to operate" (Claessens & Ratnovski, 2014, p. 5). Shadow banking institutions are not parallel to traditional banking; in fact in many cases, their activities are deeply intertwined with the traditional banking system. Similar to traditional banking, shadow-banking activities involve risk – credit, liquidity, and maturity risks – transformation. Where traditional banking transforms risks on a single balance sheet by transforming risky loans into bank deposits, shadow banking transforms risks using other mechanisms that distribute risks across the financial system. However, unlike capital market activities, as per IMF definition, shadow-banking activities require backstop as these activities still have systemic risks that cannot be distributed into the financial system. This backstop can come in the form of government through guarantee and access to lender of last resort, or through private supply of capital.

Systemic Risks

Like banks, a leveraged, imperfect credit-transferring and maturity-transforming shadow banking system can be vulnerable to "runs" and generate contagion risk, thereby amplifying systemic risk. Systemic risk, as defined by Group of Ten report, is "the risk that an event will trigger a loss of economic value or confidence in and attendant increases in uncertainty about a substantial portion of the financial system that is serious enough to quite probably have significant adverse effects on the real economy." (Group of Ten, 2001)

Chinese Shadow Banking System

The size of the shadow banking system in China has grown in response to the limited access to credit and artificially low interest rates. According to People's Bank of China data as of 2011, general shadow banking activity comprises 41.7% of all China's financial activities (Hsu, Li, & Qin, 2013). The 2014 Financial Stability Board report on shadow banking claimed that China had the third largest shadow-banking sector, after United States and European Union (Financial Stability Oversight Council, 2012). JP Morgan estimated in a report last year that shadow banking in China nearly doubled between 2010 and 2012 to nearly US$6 trillion, or about 70% of the nation's GDP (Schuman, n.d.). These numbers reflect unfulfilled market needs to funding and investment requirements of the real economy through the traditional banking system.

Shadow financial system in China can be mainly categorized into three sectors: non-bank financial products, credit creation products, and informal financial funds. Non-bank financial products include bank-trust cooperation in financial products, products issued by trust companies and financial leasing companies, asset securitization services provided by asset management companies and other non-bank financial institutions, Q-REITS and credit risk assets. These products often directly interact with the balance sheets of commercial and investment banks. Credit creation products are non-bank loan originations, often produced by small loan companies, investment companies, financing guarantee companies, insurance brokerage firms, pawnshops, private equity investment funds, and venture capital funds. Informal financial funds are generally unregulated non-bank institutions that provide funding via lending networks, mutual assistance (Li & Hsu, 2012).

Many forms of these non-bank financial intermediaries have been in existence in China for many years, but only since 2009, when China instituted a reflation policy and loosened credit to combat the global crisis, has there been a significant global concerns that China may experience a subprime-like crisis from its shadow banking sector (Sheng, 2014). Economists are concerned that the Chinese shadow banking system is opaque and not stringently regulated; their growing nonbank credit origination activities pose indeterminate large amounts of credit risk. These credit risks may translate into systemic risk, given that activities of shadow banking and traditional banking are oftentimes interconnected.

The interconnection between shadow banking activities and traditional banking can be broken down into three layers, according to Andrew Sheng. The most highly connected to banks are Bank OSBF level, where banks provide off-balance sheet channels for financing through distributing and structuring financial products from shadow banking institutions. The credit enhancement layer, with a lower degree of connection to banks, assist in enlarging lending size through guaranteeing or lending to lower credit customers. The underlying risks could spill over through guarantees, where banks lend money to lower credit customers with the guarantee of shadow banking institutions. Lastly, non-bank lending layers serve credit demands not met for even lower credit customers, thus having minimal systemic risks.

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Chinese Trust and Investment Companies

Trust and Investment Companies (TIC), a subset of China's shadow banking institutions, were established in 1979 in order to fulfill excess demand for funding in a time where state-owned banks were the only resource for financial needs. The first Chinese TIC, China International Trust and Investment Corporation (CITIC), was formed by the State Council in response to economic liberalization policy. As CITIC's assets grew quicky, more new TICs were formed and started competing with state-owned banks, taking advantage of the looser financial regulation and supervision of trust corporations. In order to ease the problem of tight central-bank control over state-owned banks, state-owned banks were allowed to conduct trust business in 1980.

Today, TICs have become ubiquitously Chinese financial institutions that combine characteristics from private equity, asset management, and banking sectors, a far off call from how trust companies operate in the Western world. TICs are closely intertwined with the commercial banks; banks often serve as a channel of issuance and distribution of shadow banking products, in addition to banks being allowed to offer their own shadow-banking products as well. These include trust products, REITs, negotiable securities, credit default swaps, and wealth management products. As of 2011, bank-trust cooperation must be listed on the bank's balance sheet, as per Notice on Further Standardizing Bank-Trust Cooperation, in particular all TIC assets that are distributed by the banks.

A study by Hsu, Li, and Xue demonstrated that under a Markov process analysis, TICs were the most powerful engine for systemic risk, "whose systemic risk index amounted to 1.79 times that of other institutions as whole" from 2007 to 2012 (Hsu et al., 2013, p. 15). While this study comprehensively demonstrate the size of the systemic risks posed by TICs compared to other financial institutions, factors that lead to the significance of TICs' systemic risks were not looked into.

Research Question

Given the concern on TICs as a source of systemic risk in the Chinese economy, the research question we will be investigating is which factors contribute to the systemic risk posed by TICs to the economy. My hypothesis is that the factors that contribute to the systemic risk are (1) the high interdependence of TICs to other institutions, and (2) the high leverage levels of TICs.

Methodology

Allen, Babus, and Carletti show that systemic risk tends to be higher in clustered asset structures, in which banks hold identical asset portfolios, rather than unclustered asset structures, in which banks swap projects with other financial institutions but do not hold identical portfolio. Since systemic risk arises when many financial institutions fail due to a common shock, measuring the degree of contagion from a particular institution should be the first step.

The literature on systemic risk has used a variety of measures to quantify this variable including: conditional value at risk (Adrian and Brunnermeier, 2009), valuation of put options written on a portfolio of aggregate bank assets (Hovakimian, Kane, and Laeven, 2009), stochastic processes in the presence of a financial accelerator mechanism (Battiston et al, 2009), systemic expected shortfall (Richardson, 2010), and insurance against systemic financial distress (Huang, Zhou, and Zhu, 201).

I will use the following data sources:

- 64 out of 68 TICs that have publicly available financial information (2010-2013)
- Quarterly industry data provided by the China Trustee Association (2010-2013)
- 11 central government owned state commercial banks publicly available financial information (2010-2013)

Based on the available data, we will use the Markov process model used in Hsu, Li, and Xue's study, calculating a baseline systemic risk index for all the three years. Once this has been calculated, we will then conduct a regression analysis based on the two variables: (1) the high interdependence of TICs to other institutions, and (2) the low asset-liability ratio of TICs. The first variable will be quantified as the percentage of assets owned by commercial banks that are TIC products. The second variable will be quantified as the asset-liability ratio of the TICs. Fitting these two variables, we can see the correlation of these two factors to the systemic risks.

Markov Process To Calculate Systemic Risk Based on Hsu, Li and Xue's research

The literature by Hsu, Li and Xue utilizes the Markov process in order to measure systemic risk. Given the limited amount of empirical data on the subject matter, the Markov process seems to be the most ideal. It has been often been applied to network models in order to measure systemic risk. This model makes the simplifying assumption that future states depend only on the present state, not states that preceded the present state (Hsu et all, 2009). This seems to be reasonable enough in the context of the Chinese financial system, as we have observed in the only bankruptcy of a Chinese TIC – the Guangdong International Trust and Investment

Corporation – in 1999, the shock quickly escalated within months to other investment companies with the government bailing them out 4.2 billion RMB.

As per Hsu and team's paper, we will first use a matrix power series model based on a Markov process. The model asserts that shadow banking risk contagion is a dynamic ongoing process that can be regarded as a series of time intervals short enough to be used in a Markov process. When an institution defaults on its shadow banking assets, it may also default on its liabilities to other institutions, resulting in a chain of defaults. We can therefore measure the systemic risk within the shadow banking by how many defaults occur in the whole system as a result of this potential contagion,

In order to calculate this using the Markov model, we must assume that: (1) China's financial system implicitly guarantees deposits, so that there is no risk of bankruptcy due to a run on the leading institutions in the shadow banking system, (2) during the period of examination, there is no risk of institutional bankruptcy, (3) cross shareholdings which may lead to the risk of contagion can be ignored, and (4) shadow banking risk contagion can be regarded as series of time intervals short enough to be used in a Markov process model.

As Hsu has outlined in her study, the following variables and components are used in the Markov model:

1. n is the number of institutions in the shadow banking system;
2. MR_j represents the value of liabilities that institution j will default on if a particular value of j's assets are defaulted on;
3. EMR_j represents the expected value of MR_j;

4. L_j represents institution j's shadow banking liabilities;
5. E_j represents institution j's equities;
6. D_j represents institution j's defaulted assets;
7. λ_{ij} is the proportion of shadow banking liability holdings of instituion i to institution j;
8. A_t is the matrix that shows the expected value of defaulted assets generated in institution i in the wave (t) of contagion resulting from j's defaulted assets and the element of A_t is $a_{ijt;}$
9. A is the transition matrix;
10. A^* is the matrix that shows the expected value of defaulted assets generated in the whole process of contagion resulting from j's defaulted assets;
11. SR_j is systemic risk for institution j.

If institution j defaults on one unit of assets, it becomes the starting point of contagion, generating additional defaulted assets within the shadow banking process in a Markov process. In the first wave of contagion, the original defaulted assets generated by institution j create additional defaulted assets in institution k, with which institution j does related business. Then in the second wave of contagion, defaulted assets generated in institution k continue to generate defaulted assets in institutions with which it has business relations.

In order to calculate how many defaulted assets are generated in the system through the full contagion process by the institution j's unit of defaulted assets, we must first calculate the expected value of defaulted assets generated in institution i by the initial one unit of defaulted assets in institution j in the first wave of contagion. Second, we calculate the transition matrix that is needed to work out how many additional defaulted assets are generated in each round of contagion. Finally, we sum up the defaulted assets that are generated in each round of contagion.

This can be summarized in the following functions:

(1) $$MR_j = \begin{cases} 0, & D_j < E_j \\ 1, & D_j \geq E_j \end{cases}$$

(2) $$EMR_j = \frac{L_j}{L_j + E_j}$$

(3) $$a_{ij_1} = EMR_j \cdot \lambda_{ij}$$

(4)

$$A_1 = \begin{bmatrix} a_{11_1} & \cdots & a_{1j_1} & \cdots & a_{1n_1} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ a_{i1_1} & \cdots & a_{ij_1} & \cdots & a_{in_1} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ a_{n1_1} & \cdots & a_{nj_1} & \cdots & a_{nn_1} \end{bmatrix}$$

(5) $$A_t = A_1 \cdot A_{t-1}$$

(6) $$a_{ij_1} = \sum_{k=1}^{n} a_{ik_1} \cdot a_{kj_{t-1}}$$

(7) $$A^* = \sum_{t=1}^{\propto} A_t$$

(8) $$SR_j = \sum_{i=1}^{n} a_{ij}^*$$

Function 1 expresses that when the debt of institution j is smaller than the equity of institution j, this generates no liability, but when debt is larger than equity, each unit of defaulted assets has to be compensated by j's liabilities. Given the properties of the piecewise function 1, we derive function 2 to calculated expected value. We then, in function 3, calculated the amount of defaulted assets generated in the first wave of contagion by comparing there proportion of shadow banking liability holdings of institution i to institution j to function 2. Function 4 shows the first wave of transfer, how many and where defaulted assets are generated in the system. The expression of A_t can be drawn from the transition matrix as function 5. a_{ijt} proposes that if a unit of asset was defaulted in institution j at time 0, in the t-th wave of contagion, defaulted assets generated in institution i amounted to a_{ijt}. The source of risk for wave(t) of contagion is a_{kjt-1} and the negative effect from institution k to institution I is measured by a_{ik1}, expressed in function 6. A□ is the matrix that shows the expected value of defaulted assets added to institution i during the contagion process, resulting from a new unit of defaulted assets in institution j. In other words, A□ is the sum of defaulted assets generated in each wave of contagion, as shown in function 7. The function of systemic risk, since a_{ij}* is the element of A* that represents the expected value of defaulted assets generated in institution during the contagion process if a new unit of default initially appears in j, is represented in function 8.

Inherent in the Markov analysis are the following assumptions, based on Hsu's paper:

- China's financial system contains a mechanism that implicitly guarantees deposits, so that there is no risk of bankruptcy due to a run on the leading institutions in the shadow banking system
- During the period of examination, there is no risk of institutional bankruptcy, and that cross shareholdings which might lead to the risk of transmission can be ignored
- Shadow banking risk is a dynamic ongoing process that can be regarded as a series of time intervals short enough to be used in a Markov process

- Asset-liability ratio of TICs are independent to % of assets owned by commercial banks that are bank-trust cooperation

Quantifying Interdependence to the Banking System.

TICs are closely intertwined with the commercial banks. Banks serve as a channel of issuance and distribution of shadow banking products for TICs, and these products are often underwritten by the banks through "implicit guarantee" and off-balance sheet financing .This would suggest that the underwriter has some commitment at risk if they can't sell the securities to investors, exposing the bank to risk should the TICs default on the assets.

Banks supply underserved credit demand via off-balance sheet "channeling" as banks are constrained by regulatory requirements, generally providing "guaranteed return" to yield-starved investors. These are usually done through wealth management products, banker's acceptance (guarantees), security firms' asset management product, and trust cooperations (bundled loans).

In order to calculate the number of bank assets that are TIC products, we look into the financials of the banks. Given that the Chinese accounting policy since the Guangzhou International Trust and Investment Corporation's failure have enforced the disclosure of TIC products as off-balance sheet accounts with issuer information, we can calculate the TIC products banks hold and the originating TICs (Hsu et al, 2009) . Wealth management products, trust cooperation, and alternative management products, the significant TIC products that commercial banks hold, are now accountable for disclosure on a quarterly basis. Using the 11 central government owned state commercial banks publicly available financial information from

2007 to 2013, we are able to calculate the TIC products that each bank has in proportion to other assets (after adjusting for other off-balance sheet financing).

Quantifying Asset-Liability Ratio of TICs

Leverage allows a financial institution to increase the potential gains or losses on a position or investment beyond what would be possible through a direct investment of its own funds (Hulster, 2009). According to the Financial Stability Board, excessive leverage by banks is widely believed to have contributed to the 2008 global financial crisis. Leveraged institutions may create bank failures that can cause further contagion in the financial system, driven by bank failures and global risk panic (van Wincoop, 2011).

One of the studies by Hsu and Lin indicate that TICs have the lowest asset-liability ratio compared to all financial institutions in China, after assessing individual balance sheets of TICs. Portfolio losses experienced in a downturn lead to losses of bank capital that are increasing in the degree of leverage. As such, this may be a cause for worry, as the contagion of credit risks spread through the sytem either through the Bank OBSF layer or credit enhancement layer.

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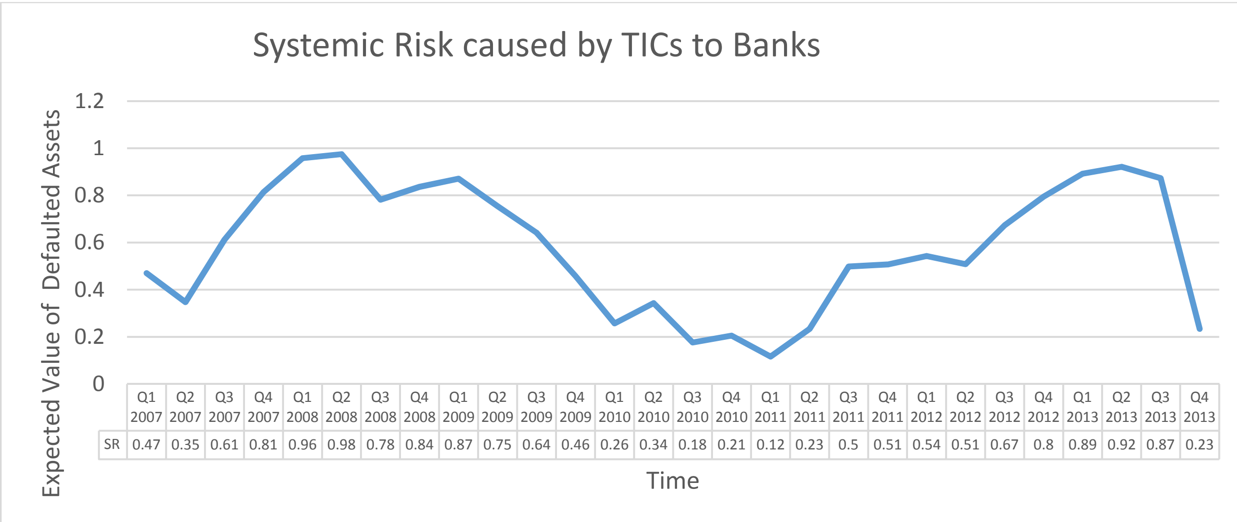
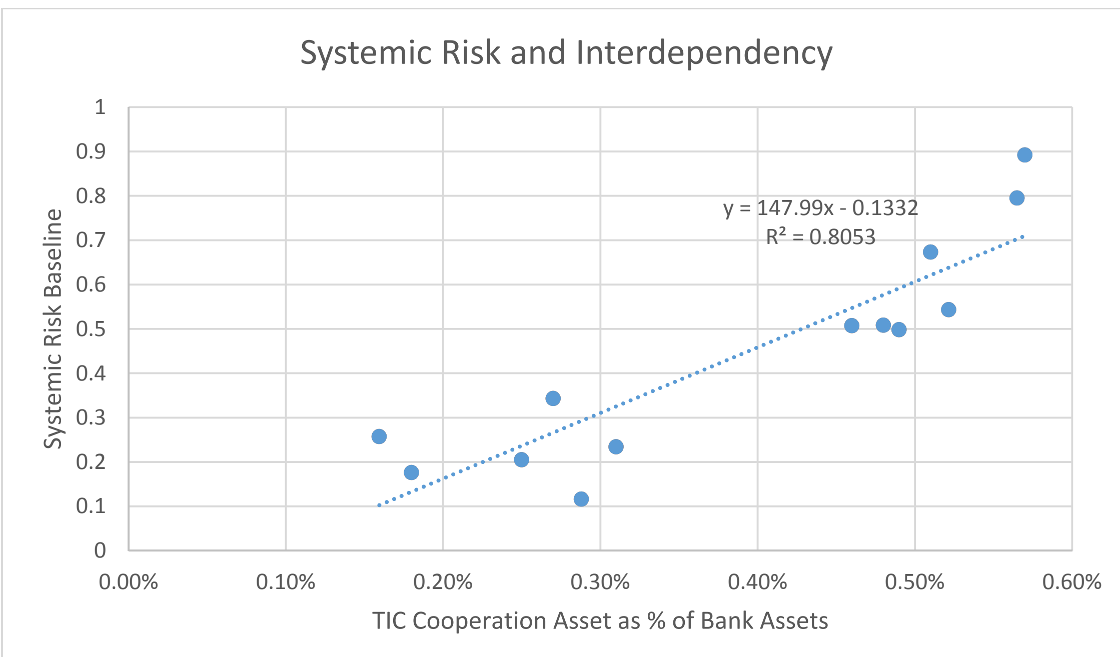
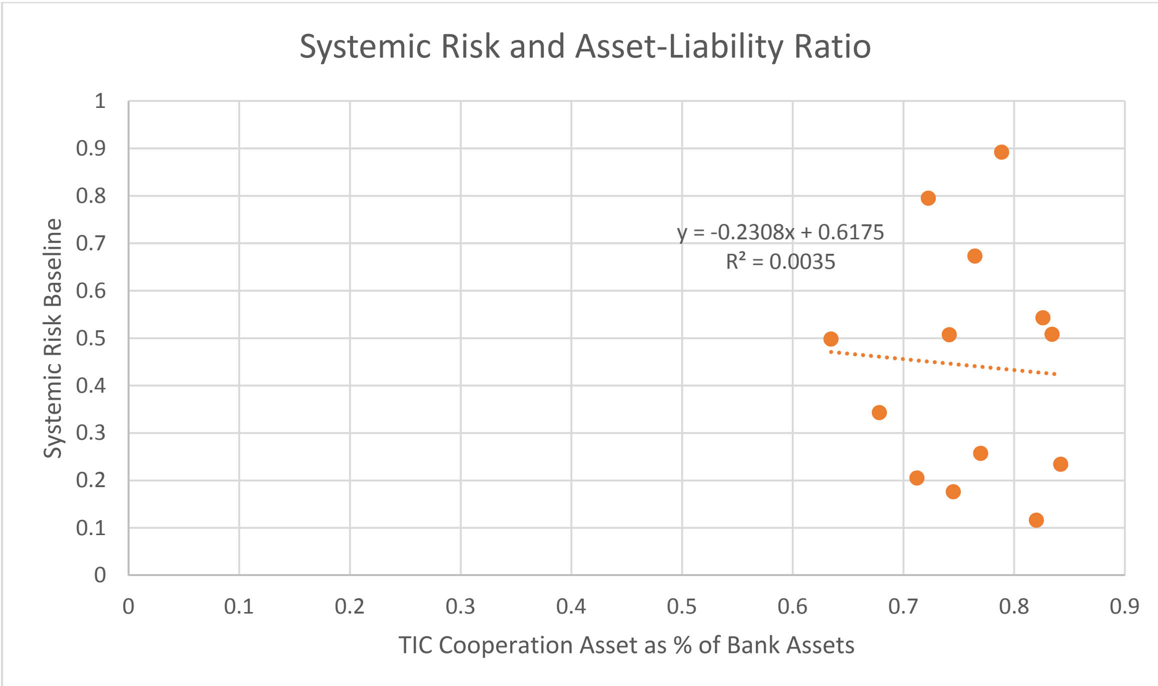
Results and Analysis







We found that by recreating Hsu's Markov process to obtain baseline systemic risk of TICs that the systemic risk caused by TICs to banks fluctuate significantly in the six years spanning from Q1 2007 to Q4 2013. TICs see two peaks of high systemic risk during this period, in 2008 during the global financial crisis and in 2013 during the speculation of China's soft landing. These two times seem in line with the hypothesis that systemic risk seem to be vulnerable at times when asset prices are falling, and economy growth uncertain.

Through a statistical regression, we found that interdependency between banks and TICs has the strongest correlation with systemic risk. With an R^2 of 0.8053, the proportion of bank-owned TIC products (through off or on balance sheet financing) seems to have some determination on systemic risk. While based on the small number in proportion to the banks' balance sheets – at below 0.57% of the banks' adjusted balance sheets, Chinese banks' risk exposures are still largely contained, should this number continue grow, systemic risks will grow in proportion as well. The overall asset size of TIC products is still moderate when compared to other assets in the Chinese economy, but may grow to be risky as yield-starved investors continue to demand for TIC products from banks with guaranteed returns.

Despite the high asset-liability ratio of TICs, there is little effect of the leverage of TICs towards the banks. The results are statistically insignificant, at R^2 of 0.0035, in line with the understanding that banks have diversified source of assets and risk-weighted asset capital adequacy policy from Chinese government since GITIC's massive failure. TIC products are given higher weightings than many assets, as such it would be unsurprising that Chinese banks have diversified enough to comply.(The Economist, 2009)

Conclusion

As of the period 2007 to 2013, it seems that the systemic risk in the Chinese shadow banking system is still largely contained. There are fluctuations over time that can be ascribed to timings of asset pricing decline, but the risks remain small to moderate. Further, the

The analysis still only completes a partial understanding of systemic risks of the Chinese shadow banking system. Understanding whether systemic risks in the Chinese financial system are largely localized or nationwide is one factor that has not yet been uncovered by this study, and would prove to be beneficial for policymakers. Further, an investigation on how the regulatory bodies interact with different shadow banking entities could also be useful in further understanding systemic risk further. In addition, the assumptions implicit in the Markov analysis make impede the practical usage of this study, as such, using other analysis such as Value at Risk could perhaps enhance our understanding of factors that contribute to systemic risks to the Chinese shadow banking system. Much also needs to be improved with financial disclosure of banks and shadow institutions, in particular with implicit guarantee from credit enhancement products, before this study can prove to be truly conclusive.

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