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The "New Shadow banks": Private Equity's Role in Reshaping Systemic Risk Transmission Channels

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ABSTRACT

This research is about the changing position of private equity firms (also referred to as the new "shadow banks") and their influence on how systemic risk travels through the financial system in China. Since the global financial crisis of 2007-2008, we have seen tremendous growth in the size of shadow banking, with private equity continuing to dominate the landscape and transform how risk spreads through traditional channels. Unlike bank-centric shadow banking, which has mainly focused on WMPs (wealth management products), private equity firms have many unique characteristics—higher leverage, longer investment horizons, different financing structures, and a lack of regulation—all of which fundamentally change the way systemic risk and its transmission operate. This study will use a dynamic complex network model to examine the influence of private equity activity on systemic risk via interinstitutional credit networks including both the 31 listed commercial banks and an aggregate of the major private equity firms in China.

The findings indicate how much more so than traditional "WMP" based ("DDD") banking - "HYP" - as well as private equity type banking - "YMNN") increases systemic defaults on behalf of institutions/decreases survival rates/up to rise to the credit support needs of all central banks' - and that are created by "shadow banking", through the provision of liquidity to lesser capitalized and less matured businesses than they might get under 'traditional WMP' methods of funding. Because of the structural issues related to maturity mismatch, high leverage and interconnectedness with commercial banks, the structural issues create a long-term systemic vulnerability around these businesses. Additionally, the lack of commonality across local vs rural banks (which again leads to an ongoing systemic vulnerability around businesses) as compared to state vs corporate banks. The key is that because of these differences in characteristics, there needs to be separate regulatory areas and levels of oversight, together with transparency by private equity and the Banking system on these relationships to enhance financial sustainability.

INTRODUCTION

Following the 2007-2008 worldwide financial collapse, multiple nations, including the US and China, introduced expansive fiscal measures to assist with recovery.[1][2]. As this occurred, the non-traditional finance industry known as Shadow Banking, developed into a new approach to non-traditional finance to augment the traditional banking system and significantly expanded over the past 10 years. Shadow Banking operates in various manners including through Assets Management Plans, Trust Loans, and Outsourced Wealth Management, providing additional credit access and enhancing investor choice.[3][4]

Of late, increased usage of financial technology and the growing abundance of such technologies has placed Shadow Banking in the global limelight and has led to increased scrutiny from governments around the world. In the United States, Investment Funds are pursuing innovative forms of shadow banking by layering complex combinations of assets on-balance sheet with off-balance sheet financing using methods that take advantage of liquid capital arbitrage.[5] In Europe, the structure of financial institutions is representative of the Great Powers, specifically Germany and the United Kingdom, and has an outsized influence on the foundational structure of shadow banking in Europe and on European banks.[6]

As the financial marketplace develops in these nations (primarily among China), commercial banks are becoming more interested in shadow banking due to the accelerating development and expansion of the financial market. As a result, shadow banking is not only a supplement to historical financial models but is also an important part of our financial ecosystem (ref).

The complex nature of shadow banking, the opacity associated with it, and its close relationship with the formal financial system, particularly the banking system, create systemic risk and also add risk to the overall financial markets—which creates instability in the financial markets and can impair the ability to have long-term economic growth.

The latest entity to contribute to the ongoing evolution of the risk associated with shadow banking is private equity firms (PEFs). In the last few years, there has been a major transformation in the structure of shadow banking; commercial banks are no longer the only major players in shadow banking primarily through wealth management products (WMPs), private equity firms have entered the traditional banking sector and are playing an integral role in the extension of credit intermediation beyond banks. PEFs are able to access an abundance of capital from institutional investors as well as affluent individuals; furthermore, they are investing this capital into long-term investments that can create very large liquidity and credit risk profiles while relying on tenuous and sophisticated types of financing.

The growing presence of "private equity shadow banking" versus "bank shadow banking" has implications that underlie systemic risk and ways it is transmitted. While much of the past literature has emphasized risks arising from wealth management products offered by banks [23,24], the increasing size of private equity firms presents a new environment for assessing transmission channels: more complex risk interconnections and modes of interconnectedness throughout financial markets, as well as fundamentally different kinds of structural liquidity risks. Unlike banks, private equity firms are less regulated and have greater operational flexibility than banks; therefore, they serve as new points of vulnerability within the financial system and have the potential to create systemic shocks by way of previously undefined means.

As there is a great deal of literature on regulatory arbitrage, credit intermediation, risk-taking, and the deleterious economic and environmental consequences of shadow banking in developing countries [18,19], there is still a significant knowledge gap related to the qualitative nature of private equity's role in changing the channels of systemic risk transmission. Due to China's hybrid financial structure — where there are elements of government and regulatory dominance, along

with frequent policy fluctuations [20] – this presents an optimal case study for examining this issue further.

China's shadow banking system has been established as following the safe and traditional model of financing available through the use of commercial banks (CB) as their primary source, whereas the more recent rise of private equity (PE) firms introduces an entirely new dynamic – key players either as independent entities or as complex partners to said banks, thereby creating some level of confusion around the roles of each.

Although there is currently no macro-prudential policy such as capital adequacy means to regulate shadow banking activities conducted by PE funds, therefore rendering them unaudited (i.e., financial risk level of PE funds is unknown and difficult to measure); past studies on financial risk have characterized financial risk predominantly using static measurements based on a single point in time thus neglecting the change in the actual underlying financial structure over time or at least within various transaction organizations.

To fill this current gap in the literature, this study employs complex network theory to reflect the financial markets (i.e., banks and financial entities) while concentrating specifically on the perspective of micro-inter-institutional credit, and through a comprehensive socio-economic analysis of the direct and indirect relationships between CB; PE; and the central bank will ultimately develop a multi-level and dynamic evolutionary model of the financial networks of these different institutions.

This model provides an opportunity to observe both the relationships between institutions as they exist at any given point in time and how those relationships may evolve over time (dynamically) and provide an indication of where risk might propagate through the network.

The year 2018 has been selected as the year of interest for this research study, since it is the only complete year wherein the enforcement of China's strict regulatory policies has had a direct exogenous impact (meaning something has happened outside of the market to cause a change to the market) on the means that both commercial banks and private equity firms govern their activities in the area of shadow banking since that year [9]. Because the data that is to be used for this research project is from both publicly traded private equity firms operating in China, as well as from publicly traded commercial banks, this research project utilizes a sample of 31 publicly traded commercial banks and a selection of large-scale private equity firms that are based in China as of December 31, 2018 to provide empirical evidence of the evolving nature of systemic risk caused by the actions of private equity firms operating within the financial system and the effect on the overall financial system's sustainability.

Furthermore, we explore the effects of this new form of shadow banking on systemic risk compared to traditional shadow banks and then provide an in-depth investigation into how the three different types of financial institutions (commercial banks and investment firms) will differ in their exposure to systemic risks from Shadow banks to better understand the different types of systemic risks that "New Shadow banks" pose.

This paper contributes to the literature in three important ways when it comes to explaining systemic risk factors for the financial system. Previous research identified a number of potential systemic risk factors directly related to banking, including bank size, asset characteristics, ownership characteristics, economic environments, and regulatory frameworks [27-31] When we identify a relationship between the role that private equity plays as a shadow bank and systemic risk, we have shown that Private Equity creates increased levels of systemic risk within the financial system of China and is thus a shadow bank that creates increased levels of systemic risk through their involvement in complex financial networks. This is significant because it will assist regulators and politicians to more effectively identify sources of risk, take effective steps to reduce risks and increase financial sustainability.

Finally, we also add new information to advance the current literature base on shadow banking regarding its systemic risk and sustainability effects. Numerous pieces of research currently published, such as studies about the impacts that shadow banks have on the overall sustainability of the financial system; the shadow banking industry's activities, size, change in characteristics, risk-taking behavior and evasion of regulations [32-35]. We contribute to advancing the literature base through our dynamic complex network methodology by developing an analytical framework to study the evolution processes and propagation mechanisms associated with the emergence of systemic risks as they relate to the operation of private equity firms within the Chinese financial markets. The results indicate that private equity firms create additional instances of default within the financial system; create lower survival rates for financial institutions; create lower profitability for financial institutions; and increase the burden on the Federal Reserve to perform bailouts of financial institutions. This research enhances our understanding of how this type of shadow banking affects the sustainability of the overall financial systems thus providing valuable information to direct policy makers and further develop our understanding of systemic risks associated with shadow banking.

The third goal of the research is to further add value to the current literature by examining the changing and evolving risks and regulations associated with shadow banks. While most of the previous literature regarding shadow banks has focused on commercial banks as operators within the shadow banking system, this literature has largely ignored the interaction between commercial banks and private equity investors who invest in shadow banks [23,36]. As a result, previous writings on shadow banks have not effectively described how risk in society can be transmitted or how risks associated with shadow banks have changed and evolved over time. Specifically, this study examines how the "New Shadow banks", affect systemic risk and financial sustainability, examines the different effects that "New Shadow banks" have on different types of financial institutions (commercial banks and investment banks), and describes the importance of having and maintaining specific and targeted forms of supervision to limit the risks of shadow banking and to support the continued development of the financial system as a whole and to establish appropriate forms of credit relations between new financial institutions and existing financial institutions.

The body of this work is organized as follows: The next chapter examines the literature relevant to this work. Chapter 3 describes how to develop and apply the dynamic financial networks methodology to create and implement a model of systemic risk. Chapter 4 provides a discussion of the data used in this study as well as the results and conclusions derived from those results. Finally, Chapter 5 presents some summary thoughts about this work.

1. LITERATURE REVIEW

1.1. Shadow Banking

The worldwide economic disaster that followed the American housing market collapse in 2008 illuminated the shadow banking industry. Since that time, serious concerns regarding how closely linked the traditional banking system is to the shadow banking system have been raised, with much focus on both the systemic vulnerability created by their close relationship as a result of the 2008 global financial crisis, and on the growing number of shadow banks [37-39]. The lack of a regulatory framework for shadow banks has created an environment conducive to excessive risk-taking behavior and led to the building of an unstable financial system [10,40]. From a theoretical standpoint, shadow banking serves as a means of avoiding capital requirements by taking advantage of the gap between relatively tight government regulations and strong regulations on commercial banks [41,42]. Due to the lack of access to regulatory protection, funds deposited with a shadow bank may be subject to high risk [43,44]. As a result of shadow banking's nature, sudden and severe liquidity shortfalls caused by shadow banking could cause widespread runs on banks and mass failure of banks. Moreover, the multiple ways in which shadow banks operate increase

the potential for high levels of systemic risk, making it difficult to achieve the goals of sustainable development [3,19,45].

China's shadow banking differs from the shadow banking present in mature markets like the United States and Europe, as it serves as a credit intermediary, facilitating credit, liquidity and term conversion [46,47]. There are three categories of shadow banking in China according to various initiators: commercial bank shadow banking; shadow banking by non-financial institutions; and private loans. The most widely used form of shadow banking in China is commercial bank wealth management products (WMPs) and non-financial institution entrusted loans [24]. In the past decade, shadow banking has developed into an important segment of the Chinese financial system and seen as an alternative source of finance for commercial banks in developing market systems [48,49]. Commercial banks have become the centre of shadow banking in China with access to improved efficiency and income through off-balance sheet shadow banking [42,50].

China's economic stimulus initiatives have led to an increase in shadow banking activity, causing it to receive heightened interest for purposes of research concerning the amount of risk it poses; Li and Lin (2016) indicated that shadow banking increases systemic risk through the excessive expansion of bank interest margins, equity risk and also deposit liabilities. In addition to this, the Chinese government does not have control over the shadow banking sector, thus, due to the presence of very high leverage ratios and significant information asymmetries, the risk of engaging in Shadow Banking activities is substantially greater than that of engaging in Financial Institutions generating Financial Assets, such as stocks and bonds (Shen et al., 2020). Using a composite index model, Shen et al., 2020 found that Shadow Banking effectively transfers risk to the financial system while distorting the ratio of riskiness of financial assets to available liquidity. According to Liu and Xie (2021), the enhancement of macro prudential regulation will increase financial friction in the financial sector, allow for the creation and growth of the shadow banking sector, and create a heightened level of regulatory arbitrage risk in the shadow banking arena. Commercial banks will continue to grow their revenues through expanding their shadow banking activities, more specifically through the increased issuance of WMP's; however, this activity poses a significant risk to the stability of the banking sector.

Moreover, the shadow banking system is an essential tool for local governments and state-owned companies in reducing their debt rollover risk by engaging in it a lot. While investors believe that pledging collateral when entering into these types of transactions can lower their likelihood of default due to receiving implicit guarantees from the enterprise or issuer [55], enterprises that are involved in the shadow banking ecosystem generally have a higher level of risk [35].

Over the last few years, the structure of the shadow banking system has experienced a major change, driven largely by the rise of private equity firms as key players in non-bank financial intermediation. With the evolution away from traditional banking-style shadow banking focused on managing funds on behalf of clients (e.g., selling investment products), the private equity sector is different in many ways relative to traditional banking-style practices and is likely to change the way systemic risk is transmitted through this sector. Private equity firms raise money from institutional investors such as pension funds, insurance firms, and sovereign wealth funds and use complicated financing arrangements with significant amounts of leverage, maturity "matching," and opaque risk profile characteristics to invest in their portfolios [5]. Furthermore, the aggregate amount of private equity assets under management on a global basis has reached record levels, and the firms are increasingly getting involved in activities typically performed by banks, including direct lending to corporations, purchasing distressed businesses, and investing in insurance products, all of which qualify as "shadow" banks [6].

The ongoing shift from banks to private equity in the shadow banking market raises some very important questions. What are the qualitative differences between the sources of systemic risk that arise from private equity's involvement in the shadow banking market compared to those

generated by banking? More importantly, how do those sources of risk propagate through the capital markets, and thus, lead to systemic risk?

While the above-named studies contributed to knowledge and understanding about shadow banking by conducting broad analyses that included mapping the connectedness of all shadow banks and their related risk to the stability of the financial system. Most studies did not provide detailed descriptions of the specific mechanics of risk propagation, nor were they able to completely investigate the mechanics at the micro level, which is a salient issue because the enactment of new regulations make it necessary to understand and model the internal dynamics of shadow banking to more effectively address the systemic risk posed by nonbank financial service institutions. Additionally, the role of private equity has not been sufficiently covered in the literature to date, as the bulk of previous research has continued to concentrate primarily on banking's role in shadow banking.

To fill this gap in extant research, we propose to develop a multi-tiered dynamic complex interbank network model that will include both traditional commercial banks and private equity as separate, but interrelated entities.

This model simulates how private equity firms and traditional commercial banks interact, and also how different entities within the shadow banking system interact with each other. By using this model, you can track and analyze the risk propagation paths more accurately than ever before, and it'll also provide you with information about where risks aggregate and where they can potentially spread to other areas. This will help further improve the ability to develop and implement regulations for shadow banks, which will ultimately help stabilize the overall financial system.

1.2 Banking Systemic Risk and Sustainability

Banking is a key factor of the finance market with the significant amount of time spent looking at how to resolve issues of banking systemic risk and sustainability [56,57]. Systemic risk within the banking industry can generally be thought as the possibility of a complete failure of the banking system due to the build-up of and passing along of risks by means of interbank lending and derivatives [58,59]. A large number of countries have adopted a vigilant and cautious stance in regard to banking systemic risk by attempting to track down where the risk arises and how it gets communicated so as to allow the banking sector to develop in a sustainable manner. This process will culminate in the formation of an extensive financial security net which will serve to reduce the number of occurrences of financial crises [60,61].

A number of different scholars have created several different types of models/methodologies to measure the systemic risks associated with banking and therefore to evaluate whether or not a banking system is sustainable. For example, tools developed by researchers (i.e., Billio et al., 2012) allow researchers to use high-dimensional statistical techniques to conduct analysis of financial data. Some of the findings from these studies suggest that systemic risks in the banking sector are highly fluctuating over time.

The CoVaR Index developed by Tobias and Brunnermeier (2016) provides an estimate of how systemic and sustainable the impact of one bank is on another when there are adverse risk situations.

The SRISK Index developed by Acharya et al. (2017) evaluates the impact of the Capital Adequacy Ratio and Leverage Ratio on systemic risk in banking systems and also sustainability in banking systems.

Meuleman and Vander (2020) created a dynamic panel framework that allows for the evaluation of both longer-term and shorter-term effects of systemic risks on sustainability in the banking sector by evaluating data regarding the bank's life cycle.

Although a number of scholars have developed different ways of evaluating the systemic risks associated with banking (and therefore the sustainability of banking systems), there are still some clear shortcomings/limits to the majority of these methods (for example, they do not incorporate the complexities and dynamics of financial markets, and they do not evaluate the complexities of relationships between financial institutions) and therefore many researchers have begun to look at banking systemic risk and sustainability from a complex network perspective [65].

Allen and Gale (2000) [58] pioneered the study of systemic risk in banks by developing an interbank network with banks as nodes. Since then, the study of systemic risk and the sustainability of banks have mainly looked at both the concentration and the connectivity of interbank networks, as well as the centrality and heterogeneity of the networks [66-68]. Lenzu and Tedeschi (2012) [69] studied endogenous banking signal confidence as a measure of how much banks can trust each other's signals, and found that banks with a high level of signal confidence typically have stronger and more systemic risk in the banking network than banks with lower levels of signal confidence. The study by Lux (2015) [70] employed combination fundamental reinforcement learning algorithms to analyze the endogenously created preference relationships among banks, and found that interbank networks with a core-periphery structure typically facilitate a greater amount of risk sharing and sustainable banking development. Zhang et al.'s (2018) [71] study examined the spread of risk contagion through both endogenous and random network structures. The results of their study showed that the effects of risk contagion were stronger in networks with random connections than in networks with endogenous connections. Additionally, the authors found out that systemic risk is significantly impacted by banks changing both debt and capital supplies and how diversified banks are in their portfolios, which can impact sustainable development of the banks through the interbank network [72-73].

The risks inherent in financial markets and the banking system encompass a variety of elements and behavioral patterns of which some researchers have explored the determining role of specific risk factors on systemic risk de-emphasizing as well as sustainability of the incumbent banking system. Because the majority of systemic postal risks come as a result of excessive credit growth during periods of economic expansion followed by credit contraction during economic contractions, it is widely understood that credit cycles are a key driver of both systemic banking risk and contrary to the sustainable development of banks [74]. Moreover, systemic bank risk and sustainability are driven by other factors in addition to the aforementioned credit cycles, including but not limited to bank size and structure of bank assets, and ownership composition [27-29]. Banking systemic risk is also significantly negatively correlated with both bank capital and the liquidity of the entire financial marketplace. Adequate amounts of liquidity will substantially reduce the risk of contagion, thus supporting and promoting the sustainable development of banks and generally prohibit the occurrence of other forms of systemic risk creation. Conversely, a liquidity crisis could lead to bank runs and increase the systemic risk of banks [10,75]. Another contributor to banking systemic risk is the nature of financial instruments, e.g. derivatives, and interbank trading behaviors i.e. those behave in an interconnected manner which significantly affect mutual valuations of related but distinct financial instruments and therefore may very well increase the likelihood that systemic risks propagate both throughout banks and banks' respective operating environments [76].

At the same time, the implementation of monetary policy by central banks, prudential supervision, fluctuations in leverage ratios as a result of the macroeconomic environment and business cycle changes also affects the determination of systemic banking risk and sustainability [30,31,77].

Additionally, the changing role that non-bank financial institutions are playing - given the rapid growth of private equity - constitutes a key area of focus relating to the study of systemic risk and sustainability. The expansion of private equity presents more systemic risk that is relevant to both researchers and regulators than ever before. Private equity firms have fundamentally different balance sheets, liability compositions, and regulatory oversight than commercial banks. They utilize significant leverage through debt financing at both the fund level and portfolio company level and create an interconnected series of credit obligations that are difficult to measure under traditional measures of systemic risk. The linkages between private equity and the traditional banking sector have also increased substantially, as commercial banks are providing leveraged loans for private equity transactions, acting as counterparties for derivatives, and increasingly lending in the private credit market directly or through co-investing [6].

The increasing mutual reliance between both private equity firms and banks suggests that distress stemming from private equity could possibly affect the banking system via several channels (e.g., through credit exposures, fire sales of assets, and counterparty risk). While the mechanisms whereby private equity activities generate systemic risks or impair financial sustainability are not yet fully understood, they represent a major research gap in the literature.

Many effective methodologies and possible risk sources have been proposed to analyze banking systemic risk and sustainability in the studies outlined previously. Some of the research conducted on the potential for interbank contagion has used methods of network theory; however, these methods do not always take into consideration the dynamic economic actions of financial institutions and the time-varying nature of systemic risks. Moreover, many of the above methods do not consider the changing nature of shadow banking, which is particularly relevant in light of private equity's increasing prominence as a source of risk, and therefore fail to take into consideration private equity's ability to create systemic risks or undermine the financial system's stability.

Following the introduction of asset management regulation in 2021, supervision and risk management of shadow banking have increased in importance. These new regulations not only change the asset management landscape but also increase the amount of scrutiny on the risks posed by non-bank financial institutions. Our goal is to fill existing research gaps by analyzing the risks assigned to non-bank financial institutions, with a focus on private equity firms using a dynamic and complex network model to characterize the unique attributes of these institutions. Our research is intended to not only provide an in-depth understanding of the impact that shadow banking risk has on the sustainable development of banks, but also to analyze how the sources of risk and the channels through which these sources transmit to banks drive systemic risk change. This methodology will enable us to better model and understand the risk transmission relationships and processes between the emergent shadow banking system and traditional banking institutions. This in-depth analysis will assist regulators in developing more effective strategies for preventing and mitigating systemic risk, thereby protecting the long-term stability and sustainable growth of the financial system.

2. METHODOLOGY

The interconnectedness of the commercial banks, shadow banking and central bank component of the financial market form the backbone of an interconnected banking network. A foundation for this research is a standard interbank model describing the three primary sub-components of the banking industry and how they take shape through a networked model consisting of the commercial banking sub-system, the networked layer of private equity firms (representing the "New Shadow banks" which act like entities involved in shadow banking) and the central bank. The purpose of the three-layered networked models is to characterize new dynamics occurring in the financial markets as time changes, and adjust accordingly. The interbank lending network links the commercial banking sector to the credit networks of private equity firms and provides insight into how the various institutions in the broader financial industry grant credit under

the supervision of the central bank. Finally, the dynamic models will provide insights into future institutional failure(s), the potential for risk contagion, and the evolution of systemic financial risk via the multi-dimensioned interbank networks.

2.1. Banking Interbank Market with Shadow Banking

In this study, the banking market network encompasses z financial agents $Z = C + S$ which include C commercial bank agents and S private equity agents symbolized by distinct categories of private equity investment vehicles (representing "New Shadow banks"). A central bank agent that executes regulatory directives is also incorporated.

Let $U = \{1, 2, \dots, Z\}$ represent the financial market at any given time, $t (t > 0)$. Financial institution connectivity can be symbolized using a binary matrix, J , where l_{ii} is either 0 or 1 $l_{ii} = 1$ denotes a credit or lending relationship between institution i and institution i ; otherwise, $l_{ii} = 0$ [66,67]. Given the unique properties of private equity operations and the inherent lack of information symmetry [78], credit or lending relationships are exclusively formed between commercial banks and between commercial banks and private equity firms, resulting in $l_{ii} = 0$ amongst private equity firms. PP represents the inter-institutional lending matrix, reflecting the lending assets or liabilities of each institution, $i \in U$, toward its associated institutions [79], via the interbank lending or credit network. The aggregate interbank lending owned by institution $i \in U$ can be denoted as $P_i = \sum_{j=1}^Z P_{ij}$. Here, the lending vector, p , is a directed vector implying that $P_{ij} \neq P_{ji}$.

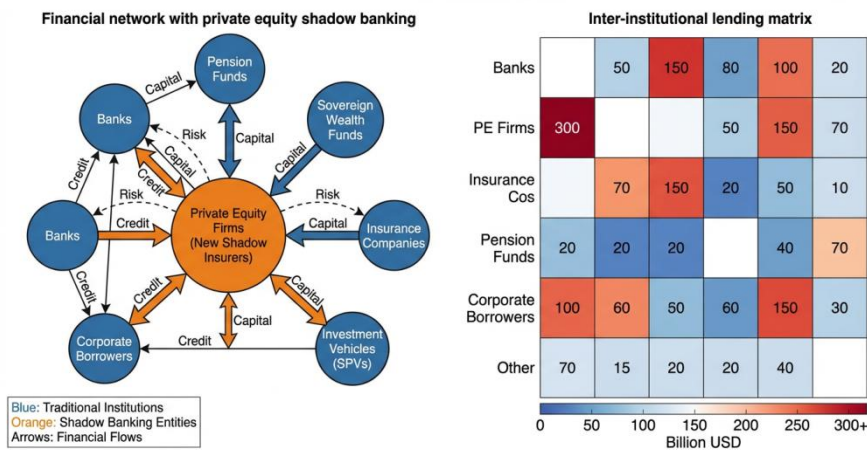


Figure 1. Financial network with private equity shadow banking (Left) and its inter-institutional lending matrix (Right).

2.2. Commercial Bank and Shadow Banking Operations

We aim to depict the dynamic evolution of financial institutions using a balance sheet. Serving as the benchmark for institutional activities, the balance sheet varies at each time point. It undergoes a dynamic evolution based on discrete time intervals, $t = 1, 2, 3, \dots, T$. For enhanced clarity when analyzing the experiment results, this study employs a simplified balance sheet structure, which encompasses two core components: assets, including liquidity, M and investment, R , and liabilities, composed of deposits or financing, T , inter-institutional lending, P , and owner's equity, O . Leveraging this balance sheet framework, we can articulate the initial liquidity of institution i in the system as follows:

$$M_i^t = D_i^{t-1} + P_i^{t-1} + O_i^{t-1} - R_i^{t-1} \quad (1)$$

where at time $t - 1$, institution i 's liquidity, deposits or financing, and owner's equity are denoted as M_i^{t-1} , D_i^{t-1} , and O_i^{t-1} respectively. The symbol P_i^{t-1} stands for the total inter-

institutional lending by institution i calculated as $P_i^{t-1} = \sum_{j=1}^Z P_{ij}^{t-1}$. When institution i borrows from institution j , $P_{ij}^{t-1} > 0$ and when institution i lends to institution j , $P_{ij}^{t-1} < 0$. Notice that $P_{ij}^{t-1} - P_{ij}^{t-2}$. If no inter-institutional lending occurs between institution j , $P_{ij}^{t-1} - P_{ij}^{t-2} = 0$. Lastly, R_i^{t-1} represents institution i 's total investment, defined as $R_i^{t-1} = \sum_{k=1}^{\pi} R_i^{t-1-k}$, which signifies institution i 's sum of investments over π investment periods.

With the evolution of the inter-institutional network and the ongoing transactions, capital circulates throughout the system causing dynamic shifts in each institution's liquidity. At the next time, t , the updated liquidity of institution i can be illustrated as follows:

$$M_i^t = (D_i^t - D_i^{t-1}) - r_d D_i^{t-1} + \tau \sum_{k=1}^{\pi} R_i^{t-k} + R_i^{t-k} + R_i^{t-\pi} \quad (2)$$

where r_d represents either the deposit or financing rate, and $r_d D_i^{t-1}$ symbolizes the interest remitted by commercial bank i to its depositors or the benefits conferred by private equity firm i to its investors. τ signifies the investment return rate. $\tau \sum_{k=1}^{\pi} R_i^{t-k}$ and $R_i^{t-\pi}$, respectively, denote the return on investment and the total investment recouped upon maturity by institution i . The unpredictability and volatility of deposits and investor financing can be attributed to various behavioral factors, subsequently inducing stochastic disturbances in institutional liquidity. In this study, we postulate that the deposits or financing, D_i^t , of institution i adhere to a normal distribution:

$$D_i^t = |\bar{D} + \bar{D}_{\sigma_{D\epsilon t}}|, \epsilon t \sim N(0,1) \quad (3)$$

where \bar{D} signifies the mean value of either commercial bank deposits or private equity firm financing, whereas σ_D represents the standard deviation of random fluctuations in both commercial bank deposits and private equity firm financing.

Within the financial system, institutions determine subsequent business operations predicated on updated liquidity status, predominantly encompassing dividend distribution and reinvestment strategies.

Should the updated liquidity of institution i exceed zero ($M_i^t > 0$), it enables the execution of dividend activities. Specifically, for a commercial bank, the structure of its dividend distribution is as follows:

$$B_i^t = \max \left[0, \min \left[\tau \sum_{k=1}^{\pi} R_i^{t-k} - d_r D_i^{t-1}, M_i^t - L_i^t, M_i^t + \sum_{k=1}^{\pi} R_i^{t-k} - (1 + \xi) D_i^t \right] \right] \quad (4)$$

$L_i^t = \lambda D_i^t$ signifies the legally mandated reserve requirement that commercial bank i must uphold at time t , where λ represents the reserve requirement ratio and ξ denotes the deposit ratio. If institution i operates as a private equity firm, its dividend distribution is different from commercial banks, and the structure of its dividend distribution is as follows:

$$B_i^t = \max \left[0, \min \left[\xi \left(\sum_{k=1}^{\pi} R_i^{t-k} - d_r D_i^{t-1} \right), M_i^t \right] \right] \quad (5)$$

where ξ symbolizes the financing ratio pertaining to private equity firm i . To streamline the discussion, this study equates the financing ratio of private equity firms with the deposit ratio of commercial banks.

Following the payment of dividends, should institution i retain a surplus of liquidity, such funds may be reinvested. When institution i functions as a commercial bank, the reinvestment adopts the subsequent form:

$$I_i^t = \min[\max[0, (M_i^t - B_i^t - L_i^t)], \psi_i^t] \quad (6)$$

In the instance where institution i operates as a private equity firm, the form of its reinvestment unfolds as follows:

$$I_i^t = \min[\max[0, (M_i^t - B_i^t)], \psi_i^t] \quad (7)$$

A crucial distinction between commercial banks and private equity firms regarding reinvestment lies in that the former falls under capital regulation obligations, whereas the latter is exempt from mandatory reserve requirements. ψ_i^t represents institution i 's investment opportunity. This study treats it as stochastic in nature, akin to deposits or financing, implying that ψ_i^t adheres to a normal distribution, given by $\psi_i^t = \left| \bar{\psi} + \bar{\psi}_{\sigma_{\psi}} \phi_t \right|$ $\phi_t \sim N(0,1)$ $\bar{\psi}$ denotes the mean investment opportunity across institutions, while σ_{ψ} represents the standard deviation pertaining to the institution's investment opportunities.

As financial networks evolve and institutional operations advance, institution i encountering negative liquidity ($M_i^t < 0$) is likely to default. Defaulting institutions will enter the defaulting institutions collection, D , and await either assistance or clearing under the central bank network.

2.3. Central Bank Assistance and Clearing

As a regulatory body, the central bank crucially ensures the stability of the financial system, primarily through capital regulation [77]. This study discusses how the central bank provides assistance to defaulting commercial banks and clears defaulting private equity firms. The procedure adopted by the central bank to assist commercial bank i is delineated as follows:

$$g_i^t = \begin{cases} L_i^t - M_i^t, & \text{if } L_i^t > M_i^t \\ 0, & \text{otherwise} \end{cases}, \quad (8)$$

The assistance rendered by the central bank to commercial bank ii is symbolized through the aid vector \mathbf{g} , which signifies the bailout amount designated for each commercial bank should they default. When the liquidity of commercial bank i falls short of the central bank's capital regulation requirements, the central bank delivers legal reserve requirement support ($L_i^t - M_i^t$). Conversely, commercial bank ii possesses adequate capital and is not reliant upon central bank support.

As private equity firms circumvent capital regulation, representing a key characteristic of the "New Shadow banks," in this study, the central bank utilizes the default mechanism referred to by Eisenberg and Noe (2001) [80] for clearing private equity firms, detailed as follows:

$$F_i^t = \begin{cases} P_i^t & \text{if } L_i^t \geq P_i^t \\ O_i^t * \frac{P_{ij}^t}{\sum_{j=1}^n P_{ij}^t}, & \text{if } L_i^t < P_i^t \text{ and } O_i^t > 0 \\ 0, & \text{otherwise} \end{cases} \quad (9)$$

where P_{ij}^t represents the lending amount transacted between private equity firm i and commercial bank j . $\sum_{j=1}^x P_{ij}^t$ constitutes the cumulative lending of private equity firm i to all commercial banks. x signifies the maximum count of commercial banks from which a private equity firm can secure lending; in this study, x is established as 3.

2.4. Dynamic Systemic Risk Analysis

Dynamic quantification of systemic risk enables a more precise evaluation of the financial system's stability. This study explores the influence of private equity firms as "New Shadow banks" on the financial systemic risk by adopting the calculating method proposed by Jiang and Fan (2021) [73]. It involves normalizing the average count of defaulted institutions in the interval $[t + 1, t + Y]$ and documenting the resultant systemic risk value as ZS^t as follows:

$$ZS^t = \frac{1}{YH} \sum_{f=1}^H \sum_{y=t+1}^{t+Y} \frac{A_f^y}{W_f^y} \quad (10)$$

where Y is defined as the time interval. The systemic risk at any given time can be represented by the average ratio of defaulting institutions in the upcoming period, Y . This study sets Y to be equal to 10. H represents the total number of system operations. The number of defaulting institutions during the f th system run is denoted as A_f^y , whereas w_f^y denotes surviving institutions. The algorithm applied to discern defaulting institutions, surviving institutions, and calculate defaulting institutions is shown in Figure 2, which is divided into the following 5 steps:

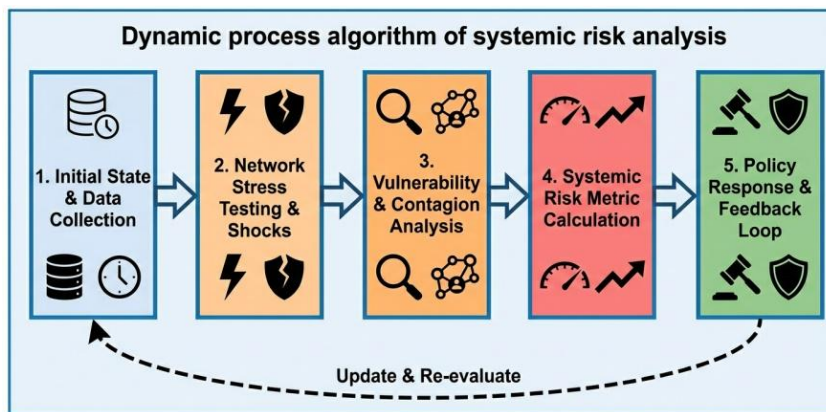


Figure 2. Dynamic process algorithm of systemic risk analysis

3. RESULTS

After implementing zero-tolerance regulatory regimes in China following 2018, banks that engage in shadow banking activities now face regulations imposed by banks featuring countless regulatory constraints defined as "non-government-related." As a result, all banks would be evaluated post-2018 from a quantitative perspective regarding their performance under these non-government regulations; therefore, the years assessed for data analysis within the research project would be 2018'2019; thus, the full extent of this study's data collection efforts exclude any year other than the year of 2018 or prior.

This project used a representative sample of thirty-one (31) listed commercial banks operating within China, categorized into three types: State-Owned, Joint-Stock, and City Commercial. Public records confirm that State-Owned banks and Joint-Stock banks are typically large and considered, Systemically Important, because of the volume of lending that occurs through each type institution. For Small/City Commercial institutions, because of their size, they display great dependency on sustainability as measured by lending ratios (or initial deposit-to-assets ratios). Furthermore, to accurately depict what "New Shadow banks" do, data was collected from all major Private Equity investors who are actively doing business within China and classify themselves

based on either their investment time-frames, leverage levels, or how they are integrated with any particular commercial bank institution.

Table 1. Commercial Banks List

Stock Code	Bank Name	Stock Code	Bank Name
601988	Bank of China (BOC)	600000	Pudong Development Bank (SPDB)
601939	China Construction Bank (CCB)	2142	Bank of Ningbo (BONB)
601398	Industrial and Commercial Bank of China (ICBC)	2839	Zhangjiagang Rural Commercial Bank (ZRCB)
600926	Bank of Hangzhou (BOH)	600908	Wuxi Rural Commercial Bank (WRCB)
601166	Industrial Bank Co., Ltd. (CIB)	601288	Agricultural Bank of China (ABC)
601328	Bank of Communications (BCM)	601997	Bank of Guiyang (BOG)
600928	Bank of Xi'an (BOX)	601009	Bank of Nanjing (BON)
1	Ping An Bank Co., Ltd. (PAB)	2958	Qingdao Rural Commercial Bank (QRCB)
600016	China Minsheng Bank (CMBC)	2936	Bank of Zhengzhou (BOZ)
600036	China Merchants Bank (CMB)	600919	Bank of Jiangsu (BOJ)
601998	China CITIC Bank (CITIC)	2807	Jiangyin Rural Commercial Bank (JRCB)
601818	China Everbright Bank (EB)	603323	Suzhou Rural Commercial Bank (SZRCB)
600015	Hua Xia Bank Co., Ltd. (HB)	2948	Bank of Qingdao (BQD)
601169	Bank of Beijing (BOB)	601577	Bank of Changsha (BCS)
601229	Bank of Shanghai (BOS)	601838	Bank of Chengdu (BOCD)
601128	Changshu Rural Commercial Bank (CRCB)		

Many studies [23] say that WMPs from commercial banks are an example of shadow banking. WMPs vary as to time frame and investment cycles; the time frames constitute the primary categorizing factor of WMPs from commercial banks. WMPs from commercial banks can be divided into five categories based on the investment cycle: WMP's less than one month; WMP's from one month to three months; WMP's from three months to six months; WMP's from six months to twelve months; WMP's greater than twelve months. The five categories of WMP's are presented in Figure 3 and include numbers issued between March 2016 and June 2018. The majority of issuances fall within the first three categories; the issuance numbers from the first three categories (shadow bank I, shadow bank II, and shadow bank III) are vastly higher than the last two categories of issuances. Therefore, the first three categories of WMP's represent all WMPs issued by shadow banks.

Based on a study conducted by private equity firms that represent the "New Shadow banks" sector, the funds are categorized into three separate forms of classification. The classification includes the following categories: (i) a large-cap buyout firm that specializes in leveraged buyout transactions, has an extended investment horizon, and has committed to funding the purchase of approximately \$500 billion to complete this transaction; (ii) a growth equity firm that focuses on making growth-oriented financing commitments during company's expansion phase that typically include moderate levels of leverage; and (iii) a distressed asset finance group engaged in making turnaround financing investments that often have complicated financing structures. Each type has completely different relationships with commercial banks as well as different risk profiles.

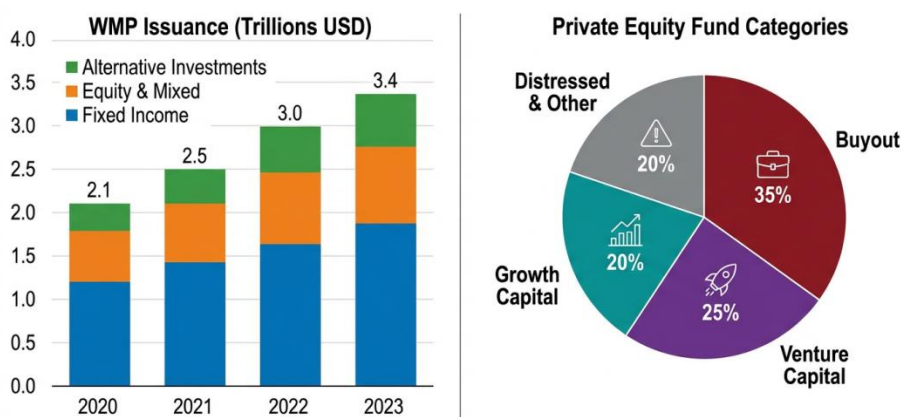


Figure 3. Commercial bank's WMP issuance statistics and private equity fund categories

For data concerning commercial banks there was manual collection of information within the annual reports of the banks as well as from the Chinese Stock Market and Accounting Research [CSMAR] Database. The macro data (e.g., Central Bank data) was collected from the People's Bank of China. For the three types of WMPs, which traditionally fall under shadow banks, information was sourced via the WMP manual and the Wind Database. With regards to Private Equity, information such as fund sizes, leverage ratios, investment horizons, and bank credit exposure was collected from Private Equity Fund disclosure documents, industry reports and the China Private Equity Association database. All review of financial systemic risk was performed using MATLAB R2023b on algorithms to perform analysis. The variable definitions can be found in Table 2.

Table 2. Summary Statistics of Commercial Banks and Private Equity Firms (2018)

Variable	Commercial Banks (N=31)		Private Equity Firms (N=24)	
	Mean	Std. Dev.	Mean	Std. Dev.
Balance Sheet Variables (CNY Billion)				
Total Assets	3,842.56	5,213.42	78.34	124.56
Total Liabilities	3,521.34	4,876.21	52.67	89.34
Owner's Equity	321.22	341.18	25.67	35.22
Liquidity (M)	124.56	98.34	12.34	18.67
Total Investment (R)	456.78	567.23	45.67	67.89
Operational Variables (%)				
Return on Assets (ROA)	0.89	0.34	8.67	4.23
Leverage Ratio	11.23	2.45	3.12	1.56
Interbank Exposure Ratio	18.34	7.89	34.56	12.34
Investment Horizon (Years)	2.34	1.23		

This research intends to explore the relation between China's systemic financial risk and shadow banking activities (including common WMPs and private equity) as well as their effect on sustainable development in China's finance. In order to have a basis for comparison, systemic financial risk for China's financial system without shadow banking will also be examined. The impact of shadow banking on China's systemic financial risk can be seen in Figure 4.

It appears that both financial systems had high levels of systemic risk at the outset as a result of institution heterogeneity. Differences in the underlying nature of the business activities create erratic fluctuations of liquidity and thus increase systemic risk. Over time systemic risk has declined and stabilized as a result of the finance system's inherent self-regulatory capacity to deal with manageable risk and reduce total systemic risk.

This corresponds with what one would observe in as compared with what can be observed independently of the shadow banking system and reflects current realities in China's own banking system. A higher level of systemic risk exists for banking systems which have both shadow banking components and banking systems without shadow banking components will create a significant

increase in the level of systemic risk within banking systems in total as a result of the shadow banking components of China's overall financial system. The addition of new private equity firms in addition to traditional WMP-based shadow banks and the shadow banking components contribute to a much higher overall level of systemic risk than traditional WMP-based shadows due to the differences in characteristics of the type of risk associated with private equity firms' operations such as higher leverage and longer investment time frames among many other factors. This strengthens the conclusion regarding shadow banking being a high risk, low sustainability type of entity [44].

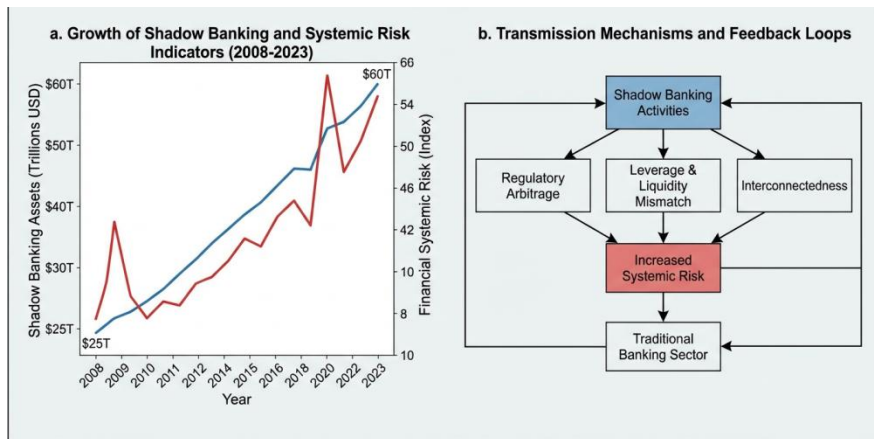


Figure 4. Effect of shadow banking on financial systemic risk

This research has demonstrated that shadow banking activities have had a considerable effect on systemic risk in China's financial system. Additionally, we are now examining how those effects play out. Three of the major measures of the health of the Chinese financial system (the total number of institutions that have defaulted to date; the survival rates of institutions; the amount of money that has been used for central bank bailouts) are shown together in figures 5a, 5b, and 5c. The comparison being made is between the financial systems that were operating with shadow banking (pre-2008) and those that were operating without any form of shadow banking activity (post-2008). In general, the initial introduction of shadow banking into the Chinese financial system did not show significant effects either way. In fact, the presence of shadow banking in the Chinese financial system seems to provide more stability than that provided by financial systems operating without shadow banking. As time goes on however, it has been shown that there has been an increase in the overall number of institutions that have defaulted and filed for bankruptcy due to the availability of shadow banking operations, that the overall rates at which institutions are surviving have decreased, and that the amount of bank bailouts being used has increased significantly since 2008 (this is shown in figures 5a-c). Therefore, it seems likely that the introduction of shadow banking into China through regulatory arbitrage has provided an ample source of liquidity to Chinese financial institutions and has also significantly reduced the systemic risk in the overall Chinese financial structure and also provide a stable financial system over short term (until regulatory changes are put into place to regulate this area of the financial markets).

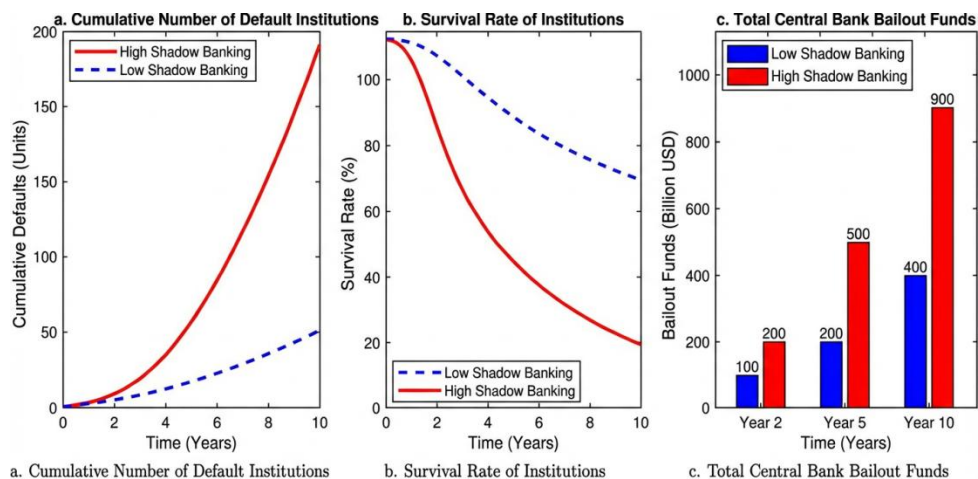


Figure 5. (a-c) Effects of shadow banking on the cumulative number of default institutions, the survival rate of institutions, and the total amount of central bank bailout funds within the financial system, respectively.

Shadow Banking Activities provide an indirect means of mitigating Systemic Risk through enhancing Liquidity, Investment Opportunity, and Average Profit. A detailed analysis of the effect of shadow banking activities within the Financial System can, in fact, provide insight into how these activities contribute to Systemic Risk and Sustainable Development of China's Financial System. Figure 6 outlines the impact of shadow banking activities on the Financial Systems' Liquidity, Investment Opportunity, and Average Profit. Shadow Banking Activities improve the Financial Systems' Liquidity, as evidenced in Figure 6a. The improvement in Liquidity is associated with the ability of Shadow Banking Activities to evade regulatory restrictions, such as Capital Adequacy Standards, Limitations on Credit Size, and Limitations on Types of Investment Projects, thereby reducing Liquidity Constraints and increasing the amount of available Liquidity in the Financial System.

Moreover, Private Equity Firms create additional liquidity in the Financial System through their ability to attract Long Term Committed Capital from Institutional Investors. However, the provision of this additional liquidity is subject to certain limitations associated with the investment's Lock-up Periods and Redemption Limitations. Finally, as depicted in Figure 6b, similar to the impact of Shadow Banking Activities on Liquidity, Shadow Banking Activities may also provide additional Investment Opportunities for Institutions in the Financial System.

Shadow banking enables the provision of substantial liquidity to institutions allowing for increased investment choices and resource allocation. As a result, it increases the number of investment opportunities in China's financial system when compared with financial systems without shadow banks. However, even though shadow banks can increase institutions' average profits initially (as represented in Figure 6c), their average profit decreases over time and often goes negative. This illustrates that shadow banking's high-profit arbitrage activities, via regulatory avoidance, provide fast, high returns but ultimately reduce returns as shadow banking's regulatory arbitrage activity increases the amount of systemic risk it creates. In addition, the initial increase of profit attributable to private equity firms is significant because of the use of leverage and complex financial engineering, which increases the average profit of institutions associated with credit in the shadow banking system, thus increasing the average profit of the overall financial system's average profit. Conversely, there is a large degree of systemic risk when there is increasing regulatory arbitrage in shadow banking; if the shadow banking activity suffers defaults caused by bankruptcy, then financial institutions that have relationships with shadow banks could face significant declines and potentially negative changes to the financial system's average profit.

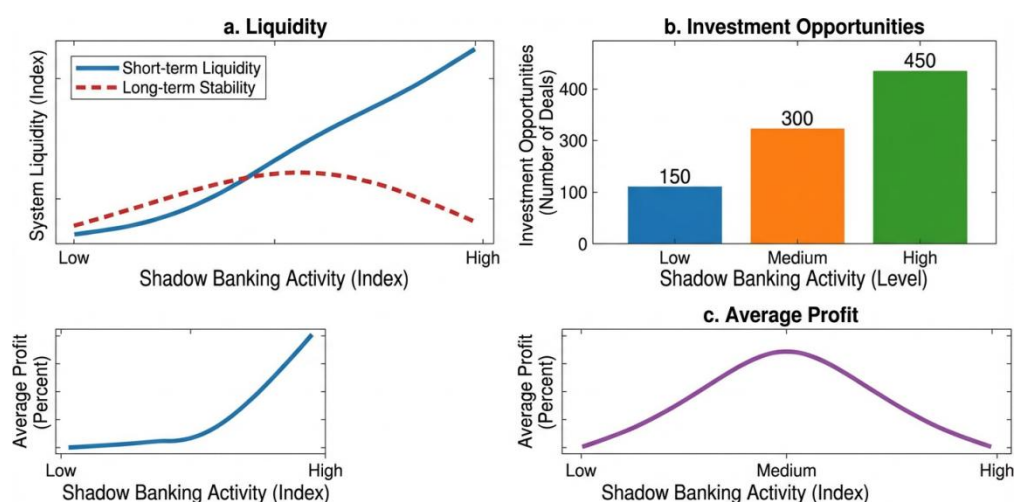


Figure 6. (a-c) Effects of shadow banking on the liquidity, investment opportunities, and the average profit of the financial system, respectively.

Table 3. Impact of Shadow Banking Categories on Systemic Risk: Simulation Results

Scenario	Cumulative Defaults	Bank Survival Rate (%)	Central Bank Bailout (Billion)	Bank (CNY)	Liquidity Index	Average Profit (%)
No Shadow Banking	124	87.3	342		0.78	1.24
Traditional Shadow Banking Only						
- Short-Term WMPs (1-3 months)	287	71.2	678		1.24	1.89
- Medium-Term WMPs (3-6 months)	234	76.8	589		1.08	1.56
- Long-Term WMPs (6-12 months)	198	81.5	512		0.96	1.34
Private Equity Shadow Banking Only						
- Large-Cap Buyout Firms	312	68.4	745		0.92	2.34
- Growth Equity Firms	256	73.2	623		0.88	1.98
- Distressed Asset Specialists	298	69.7	712		0.84	2.56
Combined Shadow Banking						
- Traditional + Private Equity	456	58.9	1,234		1.45	1.67

The above discussion illustrates that shadow banking activities contribute greatly to the sustainability of China's financial system by impacting liquidity, investment opportunities and average profitability in the economy. Therefore, an in-depth investigation into the effects on the financial system of various forms of shadow banking activities (i.e., traditional shadow banking with WMPs (shadow banks I, II and III) and private equity as a basis for shadow banking) is necessary for policymakers and regulators to create appropriate regulations and controls regarding shadow banking.

As shown in Figure 7, there has been a progressive shift in liquidity, investment opportunities and average profitability for each of the three traditional shadow banking activity categories (WMPs) on the financial system. For example, the liquidity of shadow bank I (1-3 month WMPs), compared to that of shadow bank II (3-6 month WMPs) and shadow bank III (6-12 month WMPs), is significantly greater than either of the other two (see Figure 7a).

The results presented in figure 7c find that shadow bank I produces a greater average profit than both shadow banks II & III. This evidence points towards regulatory arbitrage occurring at a much higher rate when it comes to shadow banks dealing with short-term WMPs than those providers dealing with mid and long-term WMPs. This provides the means for providers of shadow banking activities - particularly when using short-term WMPs - to produce inordinate levels of return on their activities and increase their liquidity thereby having a greater influence on systemic risk, and being more resistant to financial sustainable development.

Private equity firms are emerging as "New Shadow banks" with their distinct activity patterns. Large cap buyout companies typically have longer investment horizons, exhibit lower liquidity, produce higher frequency average levels of profits, contribute to a larger, longer lasting level of systemic risk through their complex structures as well as due to their greater degree of interconnection with several commercial banks. Specialists investing in distressed assets will typically have the highest variability of profit and will contribute to systemic risk the greatest degree during down markets as their investments are made primarily in very common areas of weakness. As demonstrated by Figure 7b, Investment Opportunities offered by different categories of Shadow Banking Operations experience variation in terms of their impact on liquidity and average returns. Figure 7b shows that Shadow Banking Operations of all categories provide liquidity to the financial system while creating diverse opportunities for institutions to access Investment Opportunities. Even if the benefits produced by each type of Shadow Banking Operation differ substantially in terms of their contribution toward financial system stability, the trend toward elevated vulnerability exists across all categories.

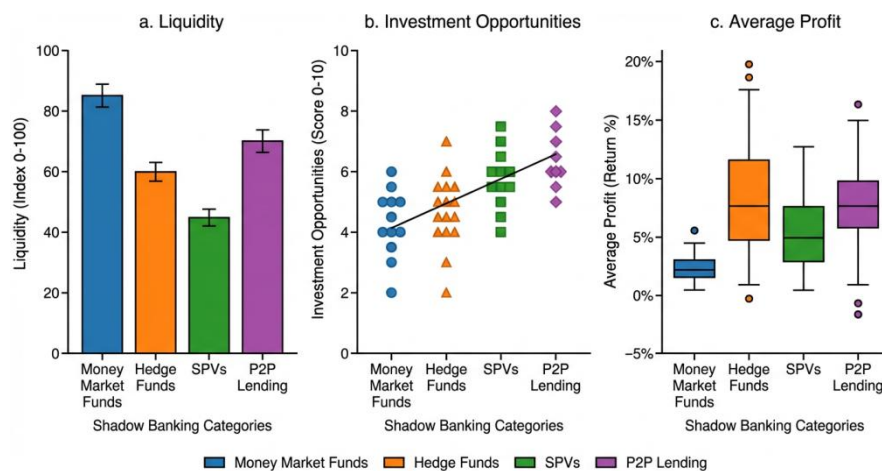


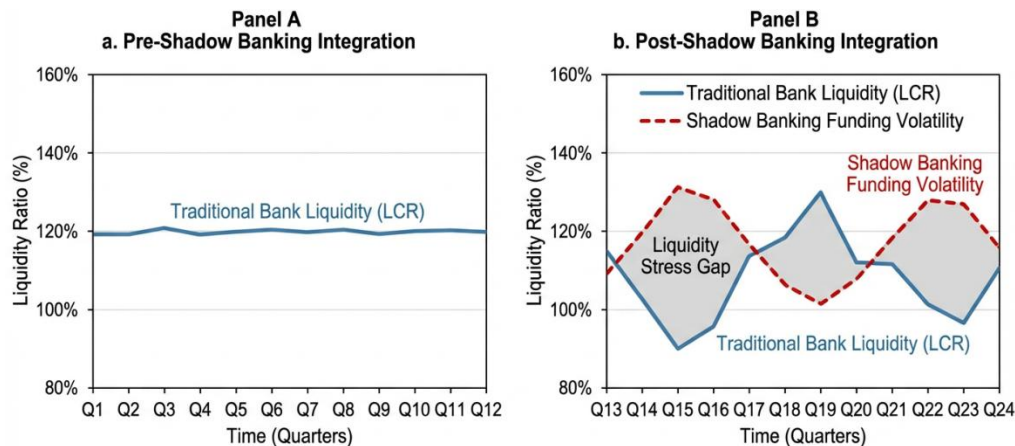
Figure 7. (a-c) Liquidity, investment opportunities, and average profit across various categories of shadow banking, respectively.

According to the above assessment, the activities associated with shadow banking have an effect on the systemic risk within the financial industry as well as the process of sustainable development. This study also seeks to explore the effect of the various types of shadow-banking transactions specifically on the different types of commercial banks, focusing on their impact on sustainable development for all commercial banks within a financial system.

The specific impact that shadow-banking transactions have on the liquidity of the 31 total listed commercial banks is depicted in Figure 8. The overall effect of shadow-banking transactions on the size of the cash of each commercial bank's liquidity is significant, as shown in the illustration above, with all 31 commercial banks showing larger amounts of liquidity when considering shadow banking as part of the financial system compared to without them. With respect to the state-owned commercial banks—BOC, CCB, ICBC, and ABC—they demonstrate greater amounts of liquidity than do the joint-stock commercial banks, the local banks, or the rural commercial banks and show relatively consistent amounts of liquidity when exclude from the calculation the effect of the shadow-banking transactions. These differences in liquidity of the banks relate to not only the size of the total assets of the commercial banks, but also their investment strategy and direction and to the state of the overall macroeconomic conditions under which the financial services are being made available. The commercial banks will have relatively stable levels of total cash liquidity across the entire system of financial institutions without any impact of shadow-banking transactions.

On the other hand, there has been a liquidity shock to the financial system as a result of shadow banking, therefore, not only have state-owned banks been affected such as Bank of China and China Construction Bank but also all Joint Stock banks including East Bank and Hope Bank, all regional banks such as Bank of Beijing and Bank of Shanghai and all rural commercial banks

such as Wanjin Rural Commercial Bank and Qianan Rural Commercial Bank have also seen major increases in the amount of liquidity they have in their respective banking systems compared to those banks previously mentioned before all these banks included private equity shadow banking to their portfolios making the liquidity effects more pronounced for banks with an existing lending relation with private equity funds; especially those who's lending was for leveraged financing for a buyout transaction. Therefore, because of the level of correlation between liquidity and systemic risk it can be concluded that shadow banking has played an important role in creating volatility within the overall financial system.



Blue Line: Commercial Bank Liquidity Coverage Ratio (LCR); Red Dashed Line: Shadow Banking Funding Flow Volatility.

Figure 8. Impacts of shadow banking on the liquidity of commercial banks

As illustrated in Figure 9, shadow banking has influenced the investment sources available to commercial banks across the financial system. As is shown, shadow banking has expanded the range of investment options available to all types of commercial banks; however, there are differences in how much each type of commercial bank has benefited from the shadow banking operations being executed. Commercial banks that are state-owned (e.g. BOC, ABC, etc.) or are joint-stock banks (e.g. SPDB, CIB) were already offering substantial investment sources prior to the execution of any shadow banking operations, and therefore, any incremental gain from executing shadow banking operations has not been overly significant for those banks. For local and rural commercial banks (e.g. BOCD, BOX, WRCB, QRCB), the execution of shadow banking operations significantly expanded the range of investment sources that are available to them compared to the state-owned and joint-stock banks. The primary reason for this is because local and rural commercial banks have relatively limited branch networks compared to state-owned and joint-stock banks, which limits their relative ability to attract deposits. As a result, shadow banking operations provide a material source of additional liquidity to the local and rural commercial banks. This also indicates the proactive business strategies local and rural commercial banks have employed to address shadow banking, in addition to having relatively greater leverage ratios than state-owned and joint-stock banks.

Private equity firms are providing smaller banks with additional options to invest in and participate in private equity-oriented financing opportunities which can generate much-needed returns. The preceding example demonstrates how Commercial Banks with different characteristics respond differently when exposed to negative shocks produced by Shadow Banking. Smaller Community Banks may experience greater exposure to material changes in response to the activities of Shadow Banking, as compared to larger, state and joint-stock banks. Because of the substantial degree to which Shadow Banking adversely impacts the sustainability of a banking system, smaller banks are also generally less assured with respect to their long-term commitment to sustaining the banking sector. However, while Shadow Banking has added to smaller institutions' opportunities to invest, it has also increased their susceptibility to risks and vulnerabilities.

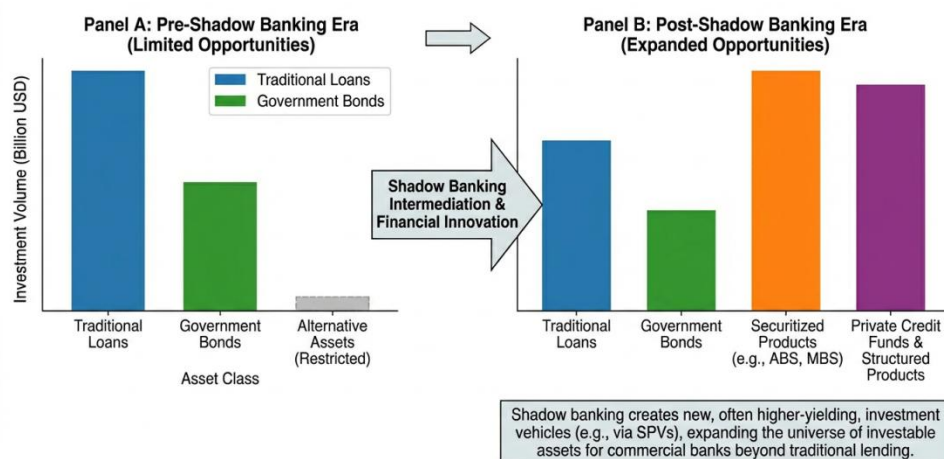
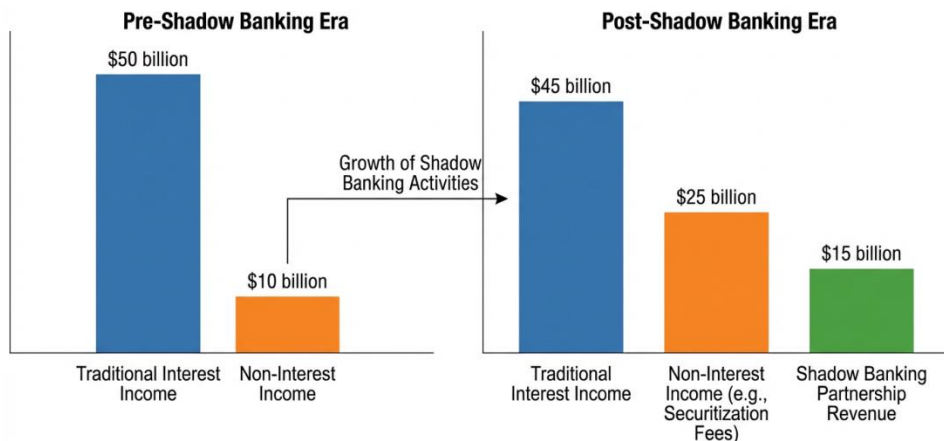


Figure 9. Impacts of shadow banking on the investment opportunities of commercial banks

Figure 10 illustrates the effect of shadow banking activity upon commercial bank profit levels within Chinese capital markets. In a financial environment that does not involve shadow banking, all commercial banks earn a profit. In particular, state-owned banks, such as Bank of China (BOC) and Industrial and Commercial Bank of China (ICBC) tend to earn much larger profits than publicly traded banks, such as China Merchants Bank (CMB) or Shanghai Pudong Development Bank (SPDB), and all of these banks earn larger profits than any of the local or regional commercial banks. The data suggest that large state-owned banks owned directly by the state have a much greater ability to earn profit, as do publicly traded banks that receive state assistance, thereby providing significant contributions to the sustainability of the banking system.

However, once shadow banking activities were introduced into the financial system, the profit levels of all commercial banks dropped significantly and became negative. This demonstrates that shadow banking activities greatly affect commercial bank profitability. While shadow banking provides significant additional liquidity to commercial banks, banks must also pay a significantly larger risk premium to compensate for the lack of liquidity resulting from the unorthodox/risky nature of shadow banking activities.

Also, commercial banks experience rollover risk from shadow banking related to maturity mismatch which is caused by having different maturities between commercial bank funding (generally short-term) and shadow bank funding (generally long-term). In addition, banks also face cyclical risk and default risk on the leveraged loans related to private equity investments. Finally, banks also experience illiquidity risk because of their private equity exposures. All of these risks create poor investment performance for commercial banks which leads eventually to declining profitability and ultimately to negative profit growth. The degree to which shadow banking presents regulatory arbitrage for commercial banks depending both on the type of commercial bank and also on the nature of the lender's exposure to shadow banking (i.e., traditional WMPs versus private equity investments). Nevertheless, negative impacts from shadow bank systemic risks creates will have a material impact on sustainable development of banking systems. Thus, there is an urgent need for credit linkage between commercial banks and shadow banks, including both traditional WMPs suppliers and private equity firms, to be streamlined; to have true regulation and oversight of shadow banking; and to create regulatory strategies that are tailored to different types of commercial banks.



Commercial banks shift towards non-interest income and new partnership models.

Figure 10. Impacts of shadow banking on the profits of commercial banks

CONCLUSION

In 2008, the People's Republic of China enacted an expansive fiscal policy intended to stabilize its economy following the onset of the global financial crisis and to create the conditions necessary for successful recovery. Unfortunately, as a direct result of the implementation of China's fiscal package, there has been a rapid increase in shadow banking activities in China. If this trend is allowed to continue unchecked, it will ultimately represent a significant risk to the long-term viability of China's financial system and economic growth.

This research examines the impact of shadow banking on the Chinese financial system, specifically focusing on the role of private equity companies as "New Shadow banks" in China's finance sector. Additionally, it will analyze the relationship between shadow banking and systemic risk in the financial sector, specifically the relationship between shadow banking and private equity through the use of wealth management products.

This research will contribute to the established literature in three primary ways: expanding the scope of the investigation into sources of systemic financial risk to include NPCs such as private equity; addressing the gap in understanding how risk propagates through the intermolecular channel from both traditional and private equity types of shadow banking, accounting for the varying degrees of economic behavior that different types of financial institutions exhibit; and finally, adding regulations designed to reduce risk aversion associated with shadow banking operations and promote the ongoing, sustainable development of the financial system. This research will also make use of institution-level micro-level data in order to further investigate the variance in the impact of the various types of shadow banking on the banking sector, including the impacts of WMP-based and private equity-based shadow banking, as well as the unique impacts of shadow banking on each of the various types of commercial banks.

This study confirms that shadow banking (including things like WMPs and private equity investments) does create and spread risk across the complex web of institution-to-institution connections, resulting in increased potential for risk exposure within China's financial system. By analysing the three main measures of risk within the financial system, it is clearly shown that while shadow banking (i.e., regulatory arbitrage and highly risky business models) may help maintain short-term financial system stability, in the long term, it will significantly increase the risk of institutional failure, decrease the likelihood of institutional survival, and increase the need for central bank bailouts. In particular, private equity firms tend to amplify these effects due to their longer investment horizon, more aggressive use of leverage, and greater levels of interconnections with commercial banks—ultimately creating persistent systemic vulnerabilities that could only be realized in periods of market turbulence. The performance of shadow banking is also assessed, with results demonstrating how shadow banking is able to circumvent liquidity restrictions imposed

by pertinent policy, thereby greatly increasing overall liquidity within China's financial system and increasing availability of investment opportunities. However, inefficient investments, caused mainly by mismatched maturities, represent a particularly high area of risk in private equity firms, due to the fact that capital is locked up for long periods, thereby reducing the overall average rate of return.

In conclusion, the findings indicate that of the three types of WMPs being examined, it is the short-term WMPs that have the greatest effect on liquidity, investing and profitability through shadow banking and, at the same time, pose the greatest potential systemic risks. For instance, different types of private equity-based shadow banks have different levels of systemic risk effects based on their investment horizons; thus, large-cap buy-out firms will generally have a more durable but delayed impact on systemic risk, while specialists in distressed assets will tend to have a disproportionate effect on systemic risk only during times of economic decline. Local banks and rural commercial banks, unlike state-owned banks and joint-stock commercial banks, are likely to be more affected by shadow banking -whether traditional or private equity based -with regard to their liquidity, investments and profits owing to the smaller number of branches and little ability to attract deposits.

The insights gleaned from the findings above signal several potential policy implications for banking regulators and policymakers in regulating and supervising shadow banking development in a sustainable manner throughout China. For example, increasing visibility of parts of the shadow banking industry through more frequent regulatory oversight in recent years has brought items in need of regulatory policy attention to the forefront, but additional specific regulatory policies tailored to individual shadow banking categories—specifically with respect to private equity (as "New Shadow banks")—continue to be lacking. Therefore, a layered regulation approach to the shadow banking industry must be deployed that correspond to the level and risk associated with specific categories of shadow banking. For example, with traditional shadow banking operating in most cases as higher-risk financial instruments such as asset-backed securities, regulatory requirements for the capital adequacy and liquidity management of these types of instruments must be sufficiently comprehensive and restrictive. Additionally, regulations for private equity firms should include enhanced disclosure requirements on leverage ratios, investment concentration, and interconnectedness to the traditional banking industry; stress-testing frameworks that take into account the unique risk factors associated with private equity operations—such as long-term investment strategies and the potential for fire sale-type activities in the event of market dislocation; should also be expanded to reflect those unique risk characteristics.

For an effective regulatory system of shadow banking, the accelerated resolution of issues surrounding information disclosures/transparency is paramount. To achieve this goal, financial regulatory bodies must implement compulsory disclosure regulations and enhance the transparency/efficacy of risk management practices in the financial markets. One way to do so would be to create a centralized information platform capturing both conventional shadow banking activity (e.g., banking system) as well as private equity activity. This centralized information platform should allow for tracking the flow of capital from commercial banks into private equity; monitoring the accumulation of leverage in the private equity space; and providing real-time information regarding the potential concentration of risk. At the same time, regulatory authorities should perform periodic assessments (i.e., stress tests) of risk related to shadow banking—including to the extent possible, scenario analyses of events occurring at the same time in both the WMP market and private equity portfolios—to allow for timely recalibration of regulatory plans to protect the stability of the financial system as a whole.

Incentives for appropriate shadow banking organizations to adopt financial technology (fintech) tools (eg, blockchain, artificial intelligence). That includes stimulating both WMP-issuing commercial banks, and private equity firms (out of the non-bank financial institutions). Fintech provides the potential for lenders and issuers of WMPs to enhance the accuracy of risk management and increase transparency in their operational structure through the use of advanced

technologies (such as blockchain) and artificial intelligence (i.e. AI). Through the use of AI, lenders and issuers of WMPs can develop more advanced risk monitoring and early warning systems. The establishment of an effective regulatory framework for shadow banking must therefore also consider the role of international cooperation. This can be accomplished by creating a comprehensive and effective information sharing mechanism that will promote consistency in regulatory policies. In order to deal with the rapidly increasing international nature of private equity funds and their associated cross-border capital movements, international regulatory coordination must be provided in order to avoid regulatory arbitrage and to guarantee that regulators apply consistent oversight.

Finally, with the high risk of spillover from shadow banking and the need for further internal risk management by financial institutions. Specifically, for private equity firms, resolution frameworks need to be developed to reflect their unique legal structures (specifically distinguishing between the liabilities of a fund and the liabilities of a portfolio company). The current transition of credit linkages from 'unconstrained' to 'constrained' financial systems should be facilitated to allow commercial banks to prudently leverage their relationships with the shadow banking system through orderly development. This entails developing prudent limits on banks' exposure to private equity funds, using higher capital charges and concentration limits for leveraged lending associated with private equity transactions to reduce the risk of excessive interconnectedness between banks, and establishing more meaningful resolutions and exit strategies from shadow banking for those banks leveraging private equity for their own capital needs. The policy recommendations outlined above represent a comprehensive, systematic, and co-coordinated regulatory framework for developing sustainable development within shadow banking—both traditional WMP activities and private equity operations as "New Shadow banks" —ultimately advancing a high quality and sustainable growth environment for the financial sector.

Investments in shadow banks have been diversely categorized. If the reader were only to look at Wealth Management Products as a proxy for the manifestation of shadow banking in financial markets, there could be bias created towards assessing the effects of systemic risk as a consequence of shadow banking on sustainable development and the limitations of the models used. This research has sought to address this limitation by bringing in private equity as an additional category of investment of shadow banking; however, there remain other forms of non-bank financial intermediation, e.g., hedge funds, family offices, fintech lenders, that present significant avenues for further research. Moreover, there is a difference in how the financial system operates in China relative to developed economies in the Western hemisphere, and the nature of the risks associated with shadow banks will differ based upon the different financial systems. Cross-country comparison studies would assist in identifying different regulatory approaches that may be most efficient depending on the context in which they are functioning. In order to assess the sustainability of banks, however; one must not only assess the internal mechanisms that give rise to their risk, but also the implications of external liquidity shocks on banks.

There are many areas that require further investigation in future research. Gathering a broader variety of data on shadow banks—such as data from hedge funds, fintech lending firms, and other types of non-bank intermediaries—would allow for a more thorough analysis of the accuracy of our model, as well as an expansion in the ways the results of this research could be used. Conducting a comparative analysis of the Chinese financial system compared with other nations can provide a wider framework for researchers to identify context-specific and universal risk transmission patterns associated with shadow banks. In addition, by focusing on the effects of specific instances of liquidity shortage throughout time—such as the cash crunches of 2013 and 2022, as well as future shocks to the private market—researchers will gain a greater understanding of how liquidity risk impacts shadow banking activities. The response of private equity markets during times of liquidity stress is particularly important, as they are inherently illiquid and depend upon continued access to debt. Researching these types of events will allow researchers to offer better and more thorough recommendations for developing financial regulatory policies and developing banks in a

sustainable manner—keeping the overall financial system stable and able to adapt to changing shadow banking structures and emerging systemic risks.

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