

PEOPLE'S REPUBLIC OF CHINA

FINANCIAL SECTOR ASSESSMENT PROGRAM

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TECHNICAL NOTE

SYSTEMIC OVERSIGHT OF FINANCIAL MARKET INFRASTRUCTURES

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This Technical Note was prepared by IMF and WB staff in the context of the Financial Sector Assessment Program in China, and overseen by the Monetary and Capital Markets Department, IMF, and the Finance and Markets Global Practice, World Bank. It contains technical analysis and detailed information underpinning the FSAP's findings and recommendations. Further information on the FSAP program can be found at <http://www.imf.org/external/np/fsap/fssa.aspx>, and www.worldbank.org/fsap.



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Glossary

ACH	Automated Clearing House
BEPS	Bulk Electronic Payment System
BCP	Business Continuity Planning
CBRC	China Banking Regulatory Commission
CCDC	China Central Depository & Clearing Corporation Limited
CCP	Central Counterparty
CFFEX	China Futures Exchange
CIPS	Cross-border Interbank Payment System
CIRC	China Insurance Regulatory Commission
CIS	Check Imaging System
CLS	Continuous Linked Settlement
CMG	Crisis Management Group
CNAPS	China National Advanced Payment System
CNCC	China National Clearing Centre
CNY	Chinese Yuan
CPMI	Committee on Payments and Market Infrastructures
CPSS	Committee on Payment and Settlement Systems
CRO	Chief Risk Officer
CSD	Central Securities Depository
CSDC	China Securities Depository and Clearing Corporation Limited
CSP	Critical Service Provider
CSRC	China Securities Regulatory Commission
DCE	Dalian Commodities Exchange
DTCC	Depository Trust and Clearing Corporation
DVP	Delivery versus Payment
EU	European Union
FCPS	Foreign Currency Payment System
FIFO	First-in-First-out
FMI	Financial Market Infrastructure
FSB	Financial Stability Board
FX	Foreign Exchange
HKSFC	Hong Kong Securities and Futures Commission
HVPS	High-Value Payment System
IBPS	Internet Banking Payment System
IMF	International Monetary Fund
IOSCO	International Organization of Securities Commissions
IRS	Interest Rate Swap
JMC	Joint Ministerial Committee for Financial Regulatory Coordination
LCH	London Clearing House
MOF	Ministry of Finance
MOU	Memorandum of Understanding

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NEEQ	National Equity Exchange and Quotations
NPS	National Payment System
OMO	Open Market Operations
PBC	People's Bank of China
PFMI	CPSS-IOSCO Principles for Financial Market Infrastructures
PSD	Payment and Settlement Department
OTC	Over the Counter
RMC	Risk Management Committee
RPO	Recovery Point Objective
RTGS	Real Time Gross Settlement
RTO	Recovery Time Objective
SAFE	State Administration of Foreign Exchange
SCH	Shanghai Clearing House
SHFE	Shanghai Futures Exchange
SHCH	Shanghai Clearing House
SIPS	Systemically Important Payment System
SSE	Shanghai Stock Exchange
SSS	Securities Settlement System
SWIFT	Society for Worldwide Interbank Financial Telecommunications
SZSE	Shenzhen Stock Exchange
TR	Trade Repository
ZCE	Zhengzhou Commodities Exchange

EXECUTIVE SUMMARY

China's landscape for Financial Market Infrastructures (FMIs) is one of the largest and most complex in the world. It consists of a range of payment, clearing and settlement systems, including several interbank payment systems, securities settlement systems and central counterparties (CCPs). Many of the systems have high volumes by international comparison and are systemically important at a national level. Disruptions, both operational and financial, in one of these FMIs may significantly impact the functioning of the Chinese economy. The landscape is subject to changes, following international developments, such as the establishment of a cross-border interbank payment system (CIPS) and a CCP for over-the-counter derivatives. The development of new, innovative products, for example, in the area of internet payments, is changing the landscape further.

FMIs in China have been analyzed from a supervision, oversight and systemic risk management perspective. The mission focused on overarching indicators of FMI's safety and resilience, i.e., i) supervision and oversight by the People's Bank of China (PBC) and the China Securities Regulatory Commission (CSRC); ii) system wide risks; and iii) risk management practices within systemically important FMIs. Such a system wide approach is appropriate, given China's highly interdependent and interconnected network of FMIs, banks, and other financial institutions.

Since the previous FSAP the supervision and oversight of FMIs has strengthened through the adoption of the CPSS-IOSCO Principles for FMIs (PFMI); the full implementation of the PFMI is the next step. The public adoption of the PFMI by the authorities in 2013, and the establishment of an interagency platform to assess FMIs (the 'PFMI Office') are commendable and important achievements. Full implementation of the principles by FMIs is the next step and is expected to enhance the resilience and stability of the FMIs. The level of implementation of the requirements varies greatly among the different systems. FMIs, and their authorities, are encouraged to actively reform risk management practices where needed, notably, the CSDC should improve its delivery versus payment arrangements and modernize its credit and liquidity risk management to limit potential significant credit and liquidity losses. The four futures exchanges should reorganize the risk management function over the full length of their organizations.

In order to achieve this, authorities should ensure that they get the appropriate staff levels in quantity and quality. Resources to fulfill the respective mandates are tight for the PBC and the CSRC. Despite increased responsibilities, the number of staff has not increased in line with new tasks under the PFMI and new market developments. Ensuring an appropriate level of human resources will allow adequate regulation and supervision of FMIs, which contributes to financial stability. Not only an increase in the absolute number of staff is needed, but also an increase in staff with good knowledge of international standards and risk management practices. This includes knowledge of (quantitative) risk models for CCPs, such as margin, credit and liquidity models.

The legal basis for FMI supervision should be strengthened and the mission welcomes the various legal initiatives in this regard. The current supervisory framework contains potential legal risks. A main vulnerability relates to the lack of a statutory framework for futures markets, which may potentially create legal uncertainty about the CSRC's powers to enforce change where needed. With a further growth and development of the market, for example, when new cross-sector products are

developed, such as in the OTC derivatives markets, gaps or overlaps in regulation may appear with subsequent risks for financial stability. Authorities' initiatives, such as the development of the 'China Financial Infrastructure Supervisory Rules', the drafting of a comprehensive Futures Market Law, amendments to the Securities Law, and the drafting of a dedicated National Payment System Law, are expected to strengthen the supervisory framework for FMIs and enhance clarity.

Furthermore, the mission found weaknesses in the legal framework for FMIs regarding finality and netting of transactions, which potentially expose FMIs and their participants to significant credit and liquidity risks. It is recommended to enact a comprehensive statute, or otherwise adopt statutory provisions, to provide a high degree of legal certainty for all relevant material aspects covering all FMIs. The legal basis should be strengthened among other things to provide for unambiguous recognition of settlement finality in the event of insolvency of a participant; protection of netting arrangements; provisions for bankruptcy remoteness of pledged collateral; close-out netting; and prescriptions to overcome any zero hour rules.

Cyber risk has been identified by authorities as an important supervisory topic in relation to FMIs. Authorities may strengthen their joint efforts and address this issue explicitly under the PFMI Office. A cyber security law was issued in 2016 and will come into effect as per June 2017. The 'Cyberspace at the Administration of China', which is a body under the State Council, conducts cyber security tests at a national level. With the promulgation of the cyber security law, cooperation between the PBC, the CSRC and FMIs may further improve insights on cyber security and contribute to the awareness and assessments of cyber risks. Joint crisis coordination mechanisms and testing of crisis communication protocols can further improve the management and monitoring of these risks. Where weaknesses were identified, these should be addressed in the PBC's and the CSRC's supervisory activities as a priority.

Finally, resilience of FMIs can be strengthened through the provision of central bank services to all solvent, systemically important FMIs. The PBC currently provides settlement services to the China Central Depository & Clearing Corporation Limited (CCDC) and the Shanghai Clearing House (SHCH). It may consider extending these services to the CSDC and other CCPs, under the condition that the FMIs strengthen their risk management practices, and, in addition to the CSRC's supervision, are subject to macroprudential oversight of the PBC. Although private sector liquidity must constitute the first line of defense for FMIs against liquidity shortfalls, there could be extreme circumstances in which their liquid resources turn out to be insufficient or unavailable. Providing solvent FMIs with access to emergency central bank liquidity, against adequate collateral, ensures that they can continue to make payments to counterparties and would thereby maintain the stability of the market. Furthermore, the provision of central bank accounts will reduce FMIs' exposure to commercial banks and may also be used for settlement purposes, reducing credit and liquidity risks related to the use of settlement banks.

Table 1. China: Recommendations

	Timing	Authorities
Recommendations for the oversight of FMs		
Strengthen legal framework for the regulation and supervision of FMs, through the development of a dedicated law on the supervision of FMs, the adoption of the Futures Market Law, changes to the Securities Market Law, and the drafting of a National Payment System Law.	ST-MT	PBC, CSRC
Ensure a sufficient number of staff with relevant expertise.	ST	PBC, CSRC
Strive for full and consistent implementation of the PFMI, in particular: <ul style="list-style-type: none"> • Update supervisory regulations and FMI rules to reflect the PFMI; • Improve DVP arrangements within the CSDC; • Implement a risk governance structure within the four futures exchanges. 	ST-MT	PBC, CSRC
Explicitly evaluate risks related to links of the CSDC with other CSDs.	MT	CSRC
Recommendations to manage system wide risks		
Adopt finality and netting at a statutory level in line with international standards.	ST-MT	PBC, CSRC
Supervise cyber resilience of FMs as part of the PFMI Office.	ST	PBC, CSRC
Develop recovery and resolution planning in line with international guidance.	MT	PBC, CSRC
Adopt policy to provide central bank services to FMs.	MT	PBC
Recommendations for the risk management of HVPS and SHCH		
HVPS: review fees and the timings of the intraday repo window.	ST	PBC
HVPS: review use of open market operations for intraday liquidity requirements.	MT	PBC
HVPS: review collateral haircut methodology and ensure independent validation.	ST	PBC
HVPS: operationalize mark-to-market module.	ST	PBC
HVPS: revise priority levels of instant transfer transactions.	ST	PBC
HVPS: prescribe a cut-off time for withdrawal of transactions in queue.	MT	PBC
HVPS: examine introduction of time varying fees for payment instructions.	MT	PBC
HVPS: complete and disclose publicly CPSS-IOSCO Disclosure framework.	ST	PBC
SHCH: appoint independent chair at the Risk Management Committee.	ST-MT	PBC, SHCH
SHCH: ensure regular reporting of operational and IT risks to CRO.	ST	PBC, SHCH
SHCH: dispose of exposure thresholds per clearing member.	ST	PBC, SHCH
SHCH: apply haircuts to cash collateral.	MT	PBC, SHCH
SHCH: ensure independent validation of credit models at least annually.	ST	PBC, SHCH
SHCH: conduct liquidity stress tests on a daily basis.	ST	PBC, SHCH
SHCH: further develop business continuity plans by introducing a hot site.	MT	PBC, SHCH
SHCH: increase the number of liquidity providers and settlement banks.	MT	PBC, SHCH

INTRODUCTION¹

1. Financial market infrastructures (FMIs) are typically considered systemically important due to the central role they play in interbank, money and capital markets.² FMIs provide the central infrastructure (comprised of institutions, rules, procedures, risk management frameworks and technical platforms) to clear and settle payments, securities and derivatives transactions and therefore lay at the core of the functioning of a sound financial system. If FMIs are not properly managed they can be sources of financial shocks and may potentially have a negative impact on economic and financial stability. For example, the failure of one of the payment systems or securities settlement systems can result, not only in losses spreading through the system, but also in an ineffective implementation of monetary policy and a loss of confidence in the financial system. The failure of a CCP may result in unexpected losses for its participants, and in extreme circumstances, causing systemic disruptions.

2. The main objective of this note is to analyze financial stability issues related to FMIs in China, using international standards and good practices. The analysis focuses on the capacity of the supervisory and oversight structure to identify and manage vulnerabilities related to FMIs, i.e.:

- a. the regulatory, supervisory and oversight framework, supervisory practices, available resources, transparency, adoption of international standards and domestic and cross-border cooperation and coordination;
- b. identification and management of system wide risks or common issues of concern for all or the majority of FMIs, such as legal gaps, cyber risks, and recovery and resolution planning;
- c. analyzing risks related to systemically important payment systems and CCPs, including High-value Payment System (HVPS) and the SHCH for over-the-counter (OTC) derivatives.

3. Recommendations in this note are based on the international agreed standards for FMIs, i.e., the CPSS-IOSCO Principles for Financial Market Infrastructures (PFMI). The analysis of the supervision of FMIs takes the five responsibilities for authorities of the PFMI as reference (Box 1). The note also considers guidance prepared by the FSB, and CPMI-IOSCO on resolution and recovery of FMIs, respectively, as well as CPMI-IOSCO guidance on cyber resilience for FMIs.

4. The analysis builds on findings of earlier assessments. The analysis takes into account the recommendations made during the 2011 China FSAP as well as the findings of the CPMI-IOSCO implementation monitoring assessments. The main findings of the 2011 FSAP and CPMI-IOSCO assessments are summarized in Appendix 1.

¹ The Technical Note was prepared by Gynedi Srinivas, Senior Financial Sector Expert of the World Bank and Froukelien Wendt, Senior Financial Sector Expert from the IMF, for the 2017 China FSAP. Their analysis was based on information provided by the authorities, publicly available information, as well as discussions with the PBC, CSRC, CBRC, CCDC, CSDC, SHCH, SHFE, banks, and other financial institutions. Excellent research assistance was provided by David Jutrsa and Shaoyu Guo from the IMF Monetary and Capital Markets Department.

² See Introduction to the CPSS-IOSCO Principles for Financial Market Infrastructures, April 2012. FMIs cover payment systems, securities settlement systems (SSS), central securities depositories (CSDs), central counterparties (CCPs) and trade repositories.

Box 1. The Five Responsibilities of the PFMI

Responsibility A: Regulation, Supervision, and Oversight of FMIs

FMIs should be subject to appropriate and effective regulation, supervision, and oversight by a central bank, market regulator, or other relevant authority.

Responsibility B: Regulatory, Supervisory, and Oversight Powers and Resources

Central banks, market regulators, and other relevant authorities should have the powers and resources to carry out effectively their responsibilities in regulating, supervising, and overseeing FMIs.

Responsibility C: Disclosure of Policies with Respect to FMIs

Central banks, market regulators, and other relevant authorities should clearly define and disclose their regulatory, supervisory, and oversight policies with respect to FMIs.

Responsibility D: Application of the Principles for FMIs

Central banks, market regulators, and other relevant authorities should adopt the CPSS-IOSCO Principles for financial market infrastructures and apply them consistently.

Responsibility E: Cooperation with Other Authorities

Central banks, market regulators, and other relevant authorities should cooperate with each other, both domestically and internationally, as appropriate, in promoting the safety and efficiency of FMIs.

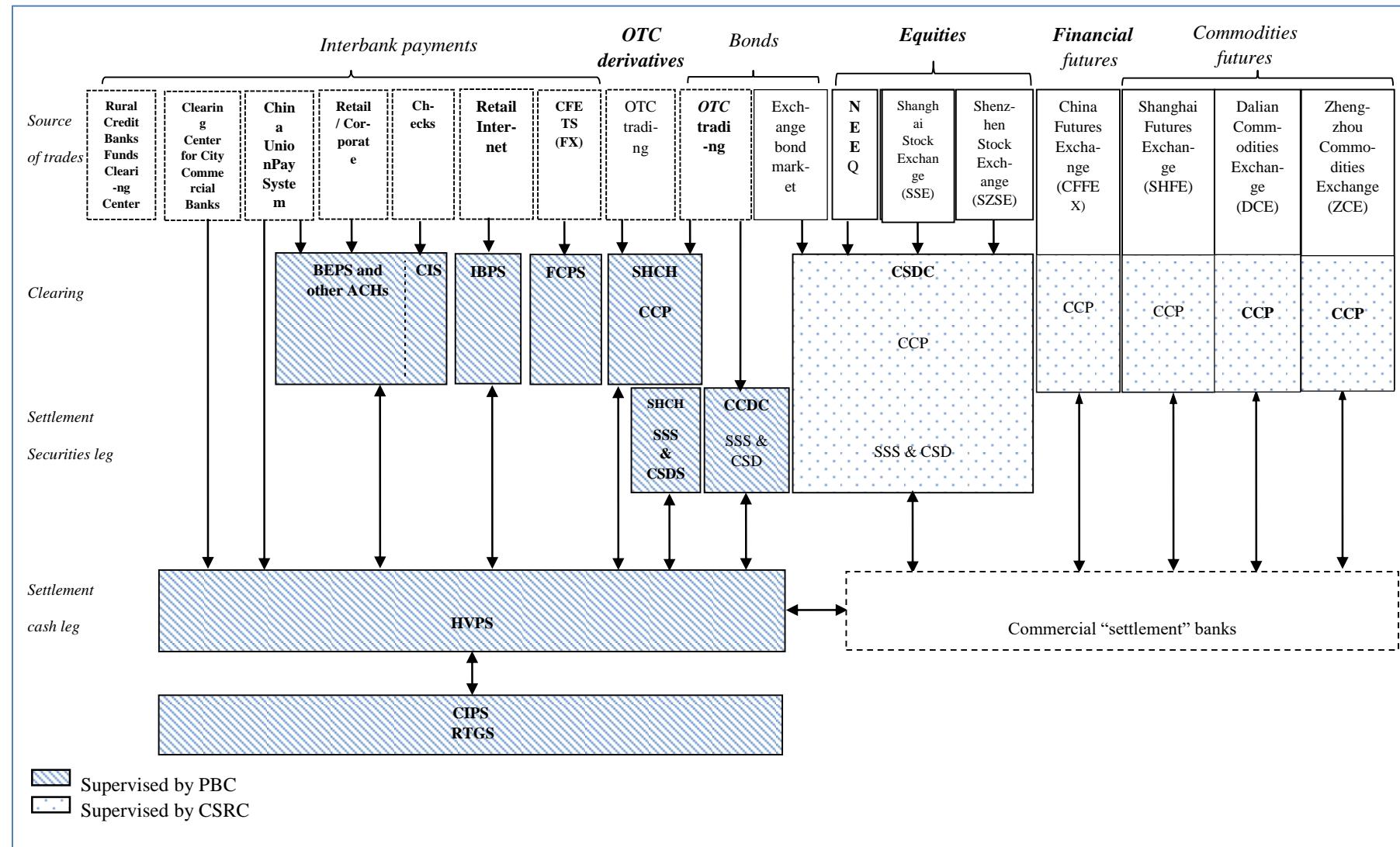
Source: CPSS IOSCO Principles for Financial Market Infrastructures, April 2012.

DESCRIPTION OF FINANCIAL MARKET INFRASTRUCTURES IN CHINA

A. Overview of Financial Market Infrastructures

5. **China's landscape for FMIs is one of the largest and most complex in the world.** It consists of a range of payment, clearing and settlement systems, including several interbank payment systems, settlement systems and CCPs for securities, exchange-traded derivatives OTC derivatives. The different systems are interlinked and settle all directly or indirectly (through their settlement banks) in the real-time gross settlement system, which is the HVPS, operated by the PBC, as illustrated in Figure 1. Many of the systems have high volumes by international comparison. For example, HVPS is the fourth largest payment system in the world, the China Securities Depository and Clearing Corporation (CSDC) ranks as the 6th largest securities CCP and the China Futures Exchange (CFFEX) ranked number 5 in 2015. Appendix 2 provides for a description of the main FMIs. Appendix 3 contains key statistics per FMI.

Figure 1. China: FMI landscape



6. In China, many domestic FMIs can be considered systemically important. The large-value payment system HVPS can be considered systemically important given its huge settlement volumes, clearing approximately 16 percent of the annual GDP on a daily basis, and its direct and indirect links to all other FMIs. The three CSDs can be considered systemically important, due to their central role in the interbank bond and securities markets and their role as custodian for CCP collateral. Also, all CCPs are systemically important as risk concentrators in various financial markets. The Bulk Electronic Payment System (BEPS) could also be considered a systemically important payment system, due to the high volumes and critical role for retail and corporate payments. Appendix 4 contains an overview of systemic indicators for the main FMIs (size, interconnectedness, substitutability and unique functions, such as facilitating monetary operations and collateral management).

7. All FMIs are state-owned. The main payment systems are owned and operated by the PBC, whereas the PBC and/or the State have ownership, directly or indirectly, in the CCDC, CIPS and SHCH. The securities and futures market CCPs and CSDC are either owned by their members or shareholders, many of which are partly or fully state-owned institutions.

B. Overview of the Supervisory and Oversight Framework

8. Authorities responsible for the supervision and oversight of FMIs are the PBC and the CSRC. The PBC is the main supervisor of payment systems and FMIs for the interbank bond, foreign exchange (FX) and OTC derivatives markets. The Payment and Settlement Department of the PBC is responsible for the regulation and supervision of the payment systems, whereas the Financial Market Department is responsible for the regulation and supervision of the CCDC, SHCH and the FCPS. The CSRC is responsible for clearing and settlement systems for corporate securities and derivatives. Its Market Supervision Department regulates and supervises the CSDC, whereas the Futures Supervision department regulates and supervises the four exchange-traded derivatives CCPs. Table 2 summarizes the regulatory and supervisory structure for FMIs in China.

Table 2. China: Overview of Authorities Responsible for FMIs

Supervisory authority	Department	FMI	Main Law
PBC	Payment and Settlement department	HVPS, BEPS, IBPS, CIS, CIPS, FCPS, ChinaUnionPay, Clearing Center for City Commercial Banks, and the Rural Credit Banks Funds Clearing Center.	PBC Law
	Financial Market department	CCDC, SHCH	PBC Law
CSRC	Market Supervision department	CSDC	Securities Law
	Futures Supervision department	CFEX, DCE, SHFE, ZCE	No law, but futures regulation

9. The State Administration of Foreign Exchange (SAFE) is involved in the supervision of the SHCH. SAFE is a subsidiary of the PBC and is responsible for policy matters related to FX markets and products. In that regard, SAFE is involved in the approval of products to be cleared by the SHCH in coordination with the PBC as supervisor of SHCH.

10. The Ministry of Finance (MOF) and the China Banking Regulatory Commission (CBRC) are stakeholders in relation to the supervision of the CCDC. The MOF as shareholder of the CCDC and issuer of government securities has an interest in the safe operations of the CCDC and regulates debt issuance, payment and custody matters, which relate to CCDC's operations. The CBRC is responsible for the appointment of the chairman of the CCDC. Furthermore, the CBRC has outsourced the maintenance of three registers to the CCDC.

C. Recent Developments

11. China's FMI landscape is changing following reforms initiated by authorities as well as private initiatives. Changes result from regulatory reforms adopted by China as a G20 member, and China's policy to open up financial markets gradually to foreign investors and cross-border trading. Also, the ongoing development and growth of markets trigger private initiatives.

12. Recent developments include:

- a. In January 2014, the SHCH started the clearing of OTC derivatives, i.e. Chinese Yuan (CNY) interest rate swaps. China is keen to comply with the commitment laid out at the G20 Pittsburgh summit in 2009 to clear all standardized derivatives through CCPs. In July 2014, clearing of CNY interest rate swaps became mandatory onshore in China for dealers and clients.
- b. In October 2015, the China's Cross-border Interbank Payment System (CIPS) was launched to facilitate the clearing and settlement of cross-border renminbi payments and to support the renminbi in becoming a major global currency. CIPS is a RTGS system that provides both onshore and offshore banks a central location for clearing renminbi payments and is directly linked to the HVPS. These features reduce the need for banks to navigate payment pathways via offshore clearing hubs or through correspondent banks.
- c. Finally, the use of e-money instruments offered by non-bank payment providers in China has grown exponentially. Amongst the non-bank payment providers are Alipay, and Tenpay, which are some of the biggest players, with Alipay having the biggest market share. Non-bank payment service providers and the products offered by them are regulated by the PBC in terms of Administrative measures for payment services provided by non-financial institutions of 2010, and Administrative measures on online payment by non-bank payment institutions of 2015. The details of the volume and value of e-money instruments from 2013 to 2015 are given in Table 6 in Appendix 3. In the coming years, these retail payments could become systemically important and any failure could impact public confidence in non-cash retail payments.

ANALYSIS OF SELECTED ISSUES

A. Oversight and Supervision of FMs

13. This section analyzes to what extent the supervisory frameworks for FMs are in line with the five responsibilities of the PFMI. The objective is to benchmark China's regulatory, supervisory and oversight framework against international standards and analyze whether there are any gaps or issues of concern that enable the buildup of systemic risk. Recommendations are made to further mitigate risks to financial stability and align the framework with international standards.

Regulation, supervision and oversight of FMs (Responsibility A)

14. The legal framework for the regulation, supervision and oversight FMs in China consists of several 'segments', along the lines of different financial markets and laws. The availability of a statutory supervisory framework differs per segment, as well as the availability of clearly defined criteria for the identification of FMs that should be subject to regulation, supervision and oversight.

15. Payment systems for interbank transactions are subject to regulation and supervision of the PBC based on the PBC law. The PBC Law prescribes that the PBC maintain the normal operation of the payment, clearing and settlement systems (article 4(9)) and shall organize, or assist in organizing, a clearing system for banking financial institutions (article 27). The PBC Law does not include explicit criteria for FMs to be subject to regulation, supervision and oversight of the PBC.

16. The PBC's role as regulator, supervisor and overseer is clear from regulations and public statements. In 2011, the PBC published the Notice of Business Supervision and Management Rules of the China Foreign Exchange Trade System. In 2016, the PBC issued the Notice on Amending the Related Management System of the Payment System, amending six regulations on HVPS and identifying "Settlement finality" in HVPS and BEPS. Furthermore, the PBC has publicly declared that it will apply the PFMI to the China National Clearing Center³, CIPS, China UnionPay, the Clearing Center for City Commercial Banks, and the Rural Credit Banks Funds Clearing Center.

17. Similarly, securities settlement systems, CSDs and CCPs for interbank bond and FX markets are regulated and supervised by the PBC based on the PBC Law and subsequent regulations and notices. In 2011, the PBC published the Notice of Business Supervision and Management Rules of SHCH, and the Notice of Business Supervision and Management Rules of CCDC. In 2014, the PBC published a notice related to the establishment of a CCP for OTC derivatives, effectively mandating the central clearing for certain CNY Interest Rate Swap contracts. Furthermore, the PBC has publicly declared that it will apply the PFMI to CCDC and SHCH.

³ China National Clearing Center is a public entity in the PBC that operates the HVPS, Internet Banking Payment System (IBPS), BEPS, Foreign Currency Payment System (FCPS), and the Cheque Imaging System (CIS).

18. Securities settlement systems, CSDs and CCPs for securities markets are regulated and supervised by the CSRC based on a statutory framework. The Securities Law (articles 155 and 157) specifies that CCPs and CSDs for the securities market are subject to the supervision of the CSRC. The CSRC has identified the CSDC as a CSD and CCP that falls under its regulation and supervision, and publicly declared that the PFMI apply to the CSDC. OTC transactions in the securities market are regulated through the Regulation for the National Equities Exchange and Quotations (NEEQ) system.

19. CCPs in the futures market are regulated and supervised by the CSRC based on a dedicated regulation and underlying measures. There is no specific law covering futures markets; the futures markets are regulated based on the Regulations on Administration of Futures Trading (2017 revision), issued by the State Council, and the Measures for the Administration of Futures Exchanges (2007), issued by the CSRC. The CSRC has identified the Shanghai Futures Exchange (SHFE), Dalian Commodities Exchange (DCE), Zhengzhou Commodities Exchange (ZCE), CFFEX and CSDC as CCPs that fall under its regulation and supervision, and publicly declared that it will apply the PFMI to these exchanges. Futures transactions in OTC markets are not covered by the existing regulations.

20. The current supervisory framework contains potential legal risks. A main vulnerability relates to the lack of a statutory framework for futures markets. Rights and obligations defined in other laws might not be (fully) consistent with the CSRC's measures, potentially creating potential legal uncertainty about the CSRC's powers to enforce changes, where needed, as its powers are based on secondary legislation. The statutory basis of the PBC's regulation and supervision does not contain clear criteria for FMIs that are subject to its oversight. This may create confusion about the scope and powers of the PBC's responsibilities in relation to the responsibilities of other authorities. With a further growth and development of the market, for example, when new cross-sector products are developed, such as in the OTC derivatives markets, gaps or overlaps in regulation may appear with subsequent risks for financial stability.

21. The mission encourages strengthening of the legal framework for the regulation and supervision of FMIs, and welcomes in that regard the following ongoing legal initiatives:

- a. Authorities have started developing the 'China Financial Infrastructure Supervisory Rules' with the intention to further develop these into a law, outlining the regulatory, supervisory and oversight responsibilities for the all relevant authorities for FMIs in China, and reflecting the principles and concepts of the PFMI.
- b. The Securities Market Law is currently being revised, seeking to add new requirements for the risk management frameworks of securities CCPs and CSDs.
- c. The CSRC drafted a comprehensive futures market law, which will provide the CSRC with a legal basis to regulate and supervise futures markets, including CCPs. The draft law may include requirements for CCPs, based on the PFMI, including finality and netting. The draft law has been send to the National People's Congress of the People's Republic of China. No timeline has been set yet for its promulgation.

- d. The drafting of a National Payments Law to provide a clear legal basis for the regulation and supervision of payment systems and payment instruments, and subsequent requirements.

22. Authorities may benchmark their proposed national model for the supervision of FMIs against jurisdictions with comparable markets in size and complexity. For example, the approach taken in the United States can be considered. Similar to China, the U.S. FMI landscape consists of a relatively high number of FMIs, which are supervised by various authorities. The Dodd-Frank Act, Title VIII, identifies supervisory agencies (i.e. the Federal Reserve, Securities Commission and Commodity Futures Trading Commission) that have a primary jurisdiction over a designated FMI, which, in case an FMI is regulated by multiple regulators, have the primary responsibility for prescribing and implementing risk management standards. In addition to the identification of primary regulators, the Act expands the Federal Reserve's role in the supervision, examination, and rule enforcement of all systemically important FMIs. For example, a primary regulator should conduct its annual examinations in consultation with the Federal Reserve as to the scope and methodology of the examination. The Federal Reserve may also participate, at its discretion, in such examinations. This approach allows the Federal Reserve, in cooperation with the other agencies, and complementary to existing supervisory and regulatory provisions, to address systemic risks consistently and strengthens its authority to induce change where necessary from a macroprudential perspective.⁴

Powers and Resources (Responsibility B)

23. The PBC has sufficient powers to obtain information and induce change or enforce corrective action if needed. Formal powers are vested with the PBC under the PBC law and various Administrative Measures. The PBC draws its powers from Articles 4 (9), 27, 32 and 46 of the PBC law. These are supplemented by Administrative measures such as: (i) Measures for the administration of the entry and exit payment system of Banking Financial Institutions; (ii) Administrative measures of PBC payment system participants; (iii) Business approach of High Value Payment System; (iv) Operational management approach of payment system of People's Bank of China; and (v) Crisis Management plan for Payment and Settlement Systems.

24. The CNCC, the operator of the main payment systems, is a public entity within the PBC, and the CCDC and SHCH are supervised by the PBC, allowing the PBC to obtain information of the payment system's functions, activities and overall financial condition, risk management, and whatever information it deems necessary. The information enables the PBC to assess adherence to the relevant regulations and policies, as well as the risks of the payment systems on its members and the broader economy. The PBC also approves the risk management measures of the FMIs before they are published. Its powers reach as far as critical service providers.

25. The legal and regulatory framework provides the CSRC with sufficient powers to supervise and oversee the CSDC and the four futures CCPs, however, the futures market should be supervised based on a law, as mentioned under Responsibility A. According to the

⁴ See, for example, the US FSAP 2015, <https://www.imf.org/external/pubs/cat/longres.aspx?sk=43057.0>.

provisions of the Securities Law, the Regulation on the Administration of Futures Trading, and other relevant laws and regulations, as well as the authorization of the State Council, the CSRC has the following powers:

- a. Request information where needed.
- b. Approval of the articles of association and business operational rules and review and approval of the appointment or removal of the general manager.
- c. Approval of the business implementation rules, relevant systems, new products and business models. Major incidents need to be reported.
- d. Evaluation of the annual performance of the CSDC and the four CCPs, including their board of directors and management.
- e. Use of enforcement tools, if needed, which include penalties, the issuance of warnings or orders to correct, confiscation of illegal gains and issuing orders to close down in severe cases. The CSRC may also use its powers towards responsible staff through warnings or eventually a disqualification.

Nevertheless, as mentioned under Responsibility A, the lack of a dedicated futures law may create legal uncertainty about the CSRC's enforcement powers.

26. The CSRC has the ability to supervise critical service providers. The CSRC published several normative documents including the Information System Audit Standards for Securities and Futures Industries, which provide the CSRC with the possibility to conduct a comprehensive assessment and on-site inspection of the IT management, server room management, network management, and key information systems used by the CSDC and four CCPs.

27. Resources to fulfill the respective mandates are tight for the PBC and the CSRC. Despite increased responsibilities the number of staff has not increased in line with the new responsibilities under the PFMI and new market developments. The Payment and Settlement Department and the Financial Markets Department have 32 and 36 staff members respectively, which is tight given that these departments are responsible for many other issues in addition to regulation and oversight of FMIs. The number of staff involved in PFMI assessments is relatively small. The PBC currently draws resources from other departments and locations. With regard to the CSRC, the CSDC is mainly regulated and supervised by the Market Supervision Department with a staff of approximately 40 members to cover all equity exchanges as well as the CSDC, of which 3 staff members are engaged in the CCP and CSD. The four futures exchanges, including the CCPs, are supervised by the Futures Supervision Department with a staff of 27 FTE, of which one staff member is involved in the supervision of the CCPs. Other departments within the CSRC may assist as needed, such as the Fund and Intermediary Supervision Department, Bond Market Supervision Department, International Affairs Department, Enforcement Bureau, and the Legal Affairs Department.

28. Authorities should ensure that they get the appropriate staff levels, both in quantity and quality. Ensuring an appropriate level of human resources, both in quantity and quality, will allow adequate regulation and supervision of the FMIs in line with the PFMI, and contributes to

financial stability. Not only an increase in the absolute number of staff is needed, but also an increase in staff with good knowledge of international standards and risk management practices. This includes knowledge of quantitative risk models for CCPs, such as margin, credit and liquidity models.

Transparency (Responsibility C)

29. The PBC discloses its policies and regulations related to payment systems. The basic policy objective of the PBC on HVPS is to "maintain normal operation of payment system and clearing systems" as stated in the PBC Law. The PBC discloses the regulations and any revisions to the regulations to the public through its annual report, website, and press announcements.

30. The PBC discloses its policies and regulations on the securities depository and the CCP for the OTC interbank derivatives bond market. The basic policy objective of the PBC for the CCDC and SHCH is "ensure efficiency, security and protection of investors' legitimate rights". The PBC Law, Administrative Measures on Bond Register and Custody in the Inter-bank Bond Market and Regulations on SHCH have defined the roles and the basic institutional arrangements of SHCH and CCDC.

31. The CSRC discloses its policies and regulations on securities depositories, clearing institutions, securities and derivatives FMIs. The basic policy objective of the CSRC on these FMIs is "ensuring safety and high efficiency". The Securities Law, Regulations on the Administration of Futures Trading, Measures for the Administration of Securities Registration and Clearing, Measures for the Administration of Futures Exchange and other relevant laws and regulations have defined the roles and the basic institutional arrangements of for these FMIs.

Implementation of the PFMI (Responsibility D)

32. The authorities have publicly stated that they adopt the PFMI. According to the Circular on Implementation of Principles for Financial Market Infrastructures (Yin Ban Fa [2013] No.187 and Zheng Jian Fa [2013] No.42) and the Circular on Conducting assessment on Financial Market Infrastructures (Document Yin Ban Fa [2013] No.239) jointly issued by the CSRC and the PBC, the PBC and the CSRC fully adopt the FMI principles.

33. The PBC and CSRC have established a Steering Group on FMIs. The PBC and the CSRC jointly released the Notice on Establishment of Steering Group and its secretariat on Financial Market Infrastructures (Document Yin Ban Fa [2014] No.106). According to the Notice, the Steering Group is responsible for guiding the development and reform of FMIs, coordinating on major issues pertaining to development and reform, and jointly promoting the implementation of the PFMI. In addition to the Steering Group, as mentioned before, a PFMI Office has also been established by both regulators. The establishment of the steering group and the PFMI office underline the authorities' commitment towards the adoption and consistent application of the PFMI in China.

34. As requested by the authorities, all relevant FMIs have carried out a self-assessment. The self-assessment was followed by an external assessment by a joint team of experts from the PBC

and the CSRC under the umbrella of the Steering Group and PFMI Office. The set timelines for the self-assessment and external assessment were January and March 2014 respectively. The PBC is currently deciding what the next step should be.

35. The implementation of the PFMI should be strengthened by reviewing and where necessary strengthening the regulations and measures of the authorities, as well as the rules of the FMIs. The CSRC is referencing the PFMI to review its regulations and measures for possible improvements. Also, the rules of the CSDC and four futures CCPs could be further updated to reflect the practices in line with the PFMI. This exercise may be accomplished by taking into account the results of the self-assessment and the external assessment. Such an approach would result in mitigating the identified risks and contribute to systemic and financial stability.

36. The team found that the compliance with the PFMI varies among FMIs. Where some FMIs seem to have adopted the PFMI largely in their rules and daily operations, i.e. the CCDC and SHCH, other FMIs would need further implementation of the requirements in their organization and daily processes.

37. Illustratively, the CSDC should be advised to improve its Delivery-versus-Payment (DVP) arrangements in the settlement of the exchange traded securities and strengthen the validation of its existing margin methodology.

- a. Although DVP is addressed in the legal framework, the actual DVP arrangements do not sufficiently protect counterparts against the loss of the full principal value of transactions. DVP should be implemented by linking the final settlement of securities to the final settlement of the funds leg. The current practice of final settlement of securities taking place on T+0 and final funds settlement on T+1 exposes CSDC to both principal and replacement cost risks. Though Article 49 in Chapter 6 of the *Regulations on Securities Registration and Settlement* states that settlement should take place in a DVP mode, it is possible for the buyer of the securities to sell the securities, before making the payment for the securities and the settlement of the funds leg. Though it is understood that there is a provision of claw-back of the securities from the buyer, this is an ex-post measure which does not mitigate the principal risk. In order to mitigate credit risk and achieve greater safety and efficiency, the authorities could introduce ex-ante measures such as: (i) blocking the delivered securities in the buyer's account till the settlement of the funds leg is completed with CSDC enjoying a lien on the blocked securities in the account of the buyer; or (ii) alternately, create a special securities account of CSDC where the securities are lodged, till the completion of the settlement of the funds leg and transferring the securities to the buyer's account thereafter. Adoption of such measures would result in mitigating credit risk and result in DVP.
- b. The valuation models used for calculation of initial margin should be independently validated by a qualified external expert on an annual basis, to mitigate model risk. At a minimum, the validation should be carried out by staff with sufficient expertise who are independent of the developers and the users of the margin model. Additionally, margin calculation and back-testing should be carried out on a daily basis, the latter to evaluate whether there are any exceptions to

the initial margin coverage. The model used to determine the adequacy of the default waterfall financial resources should also be subjected to validation.

38. In addition, the futures exchanges should further enhance the quality of their risk management framework by establishing a dedicated risk management department, in line with international best practices. The risk management department should have an independent reporting line to the Council (equivalent to the Board of Directors). This arrangement provides the advantage to the Council to get to weigh risk (as provided by the risk management department) and business potential (as reported by the Business departments) and take appropriate decisions based on the risk appetite and the type of products. In the existing arrangements, the risk management is often divided between business departments (the settlement department being responsible for stress testing) and the market supervision department for other areas of risk management.

39. The risk management governance structure of the futures exchanges should be aligned to make the risk management department responsible for managing the enterprise wide risk management, rather than the Risk Management Committee (RMC) which is an executive level body, comprising heads of departments and the Chief Executive Officer. The risk management department should lay down a clear and documented enterprise wide risk management strategy, which should be approved by the RMC and endorsed by the Council. In addition, the RMC should be chaired by a sufficiently knowledgeable individual who is independent of the executive management and it should have an independent reporting line to the Council, to which it reports on a regular basis on all matters pertaining to risk management.

40. Closer scrutiny on the composition of the components of the default waterfall and its use for taking care of the default of a participant should be carried out. The waterfall composition for instance also includes resources used for overcoming liquidity shortfalls. The financial resources in the revised waterfall composition should be subjected to the ongoing regular stress tests by the individual exchanges as also by the China Futures Monitoring Center (responsible for stress tests across all futures exchanges). The results of such examination by the China Futures Monitoring Center should be shared with the CSRC, if not already being done so. This would enable the regulator to get an overarching view on the safe and efficient functioning of the futures exchanges and would be another enabling tool in its supervision and oversight kit.

41. In line with transparency norms as outlined in Principle 23, the regulatory authorities should advise all FMs under their respective regulatory jurisdictions, to complete and publicly disclose their responses to the CPMI-IOSCO Disclosure framework for financial market infrastructures. It is noted that the SHCH and CCDC have publicly disclosed their responses to the Disclosure Framework in English and Chinese.

42. The existing governance and oversight arrangements over CCDC should be recalibrated to clearly distinguish the roles of the PBC, MOF and CBRC. The recalibration should establish the PBC as the authority responsible for overseeing the functioning of the CCDC as an FMI. The respective roles of the MOF and the CBRC should be reset taking into account the above

approach. Such a measure would provide clear reporting lines to CCDC as also help in avoiding any conflicts of interest and minimize regulatory arbitrage, if any.

43. To facilitate greater understanding of the PFMI, the CSRC may hold dedicated workshops on the PFMI for the staff of FMs on a periodical basis. This would facilitate capacity building and contribute to the ongoing implementation process of the PFMI. It is understood that the PBC already provides such workshops.

44. In line with international best practices, the operator and overseer roles of the PBC with regard to the HVPS and other payment systems are distinct. The HVPS is operated by the China National Clearing Center (CNCC), a separate public entity in the PBC, while the Payment and Settlement Department (PSD) is responsible for the oversight and regulation of all payment systems including the HVPS. The CNCC and the PSD are staffed by different personnel of the PBC

Cooperation among Authorities (Responsibility E)

45. Cooperation between the PBC and the CSRC is well established with regard to the implementation of the PFMI, through the Steering Group for FMs and the PFMI office. This cooperation could be further strengthened in the Law. The PBC is responsible for the overall planning and coordination of the implementation of PFMI, and takes the lead to report the progress to the State Council and the international organizations. This is supplemented by the establishment of the PFMI office in the PBC, consisting of technical staff of both regulators. The PBC and the CSRC invite each other into their respective assessment teams, officially exchange the self-assessment reports of the relevant FMs, and jointly facilitate the implementation of the PFMI. To ensure the efficiency and effectiveness of their regulatory cooperation, the CSRC and the PBC hold periodical meetings with the deliberations being recorded in minutes to facilitate coordination. The reviews of the legal framework, as discussed under Responsibility A, could reflect these cooperation practices to further strengthen and formalize them.

46. Domestic cooperation between the PBC, the CBRC, the CSRC and the CIRC (China Insurance Regulatory Commission) is multi-tiered. These are: (i) coordinating and cooperating through the State Council which is responsible for overall financial stability and crisis management; (ii) cooperating through the existing financial regulation and coordination mechanism, i.e., the Financial Regulatory Coordination Joint Ministerial Committee (JMC); and (iii) others. In case of a crisis event related to FMs, the authorities will coordinate under the leadership of the State Council to jointly establish an interim work team to facilitate communication, consultation and coordination. The JMC is tasked with a coordination role in maintaining financial stability and mitigating regional and systemic risks. The JMC reports to the State Council.

47. CSDC and SHCH have multiple roles as a CCP, CSD and SSS. CSDC, CCDC and SHCH are FMs that have cross-border links. The CSDC has link arrangements with the Hong Kong Stock Exchange under the Shanghai-Hong Kong and Shenzhen-Hong Kong Stock Connect programs. The CSDC also has a link arrangement with the CSD in Singapore to support transfer of share stocks, which however is limited to the shares of one listed company and the volume and value of trades is

insignificant. CCDC and SHCH linked to the Central Money-markets Unit after the launch of the Bond Connect pilot program on July 3rd, 2017.

48. As for cross-border cooperation, the CSRC and Hong Kong Securities and Futures Commission (HKSFC) have an MOU on Strengthening of Regulatory and Enforcement Cooperation under Shanghai-Hong Kong Stock Connect and Shenzhen-Hong Kong Stock Connect. In terms of regulation of the above inter-jurisdictional business, the CSRC has established a periodical coordination and supervisory cooperation mechanism with HKSFC for ensuring the safe and efficient functioning of the FMIs involved.

49. Link related risks should be evaluated by the CSRC. Evidence of the exchange of information between authorities concerning PFMI assessments of the involved FMIs, was not available in English to the assessment team. The cross-border link arrangements covered by the Stock Connect programs should be evaluated to identify, monitor and manage legal, credit, and liquidity risks, including a high level of protection of investor for the rights of the investor CSD participants.

50. The FCPS provides multicurrency services. Before adding a new currency, the PBC consults with relevant central banks of issue for their comments and suggestions. The PBC does not designate FCPS as a systemically important payment system, as its turnover is not very significant. Notwithstanding this, the PBC notifies the volume and value of the foreign currency transaction to the relevant authorities on a quarterly basis.

B. System Wide Risks

51. This section discusses common risks to which the system as a whole is exposed. The section starts with an analysis of interdependencies between FMIs and financial institutions, which shows the existence of several significant interconnections and underpins the need for resilient FMIs. The section then discusses the need for finality and netting at a statutory level and cyber security measures for FMIs. Recovery and resolution arrangements for FMIs are discussed as relatively new measures to manage extreme, but plausible circumstances. The section concludes with recommendations regarding central bank services and emergency liquidity assistance by the PBC.

Interdependencies between FMIs and Financial Institutions

52. China's landscape for FMIs is an interconnected network of financial institutions, with a significant overlap of members between multiple FMIs. Figure 2 displays the network for the main FMIs in China and 609 members, consisting of 318 banks, 239 brokers, 2 insurers, and 50 other.⁵ The large majority of members are Chinese entities.

⁵ The number of 609 is a consolidated cleaned membership set, based on the top 200 members of the CCDC and all members of the other FMIs. The different members were consolidated at the highest level possible. Data is of September 30, 2016, except for HVPS and SHCH, for which the dates are December 31, 2016 and November 24, 2016, respectively.

53. The network graph shows that the largest FMI node in the network is clearly HVPS, followed by CCDC, as these systems have the largest settlement values and the highest number of members. CSDC is the third largest FMI in turnover, and SHFE the third largest FMI in number of members. The importance of HVPS is further emphasized by direct links to other FMIs (CCDC, SHCH and CIPS) and indirect links to the remaining FMIs (Figure 1).

54. There are nine banks that have a membership in all FMIs, of which eight are Chinese banks and one is a U.S. bank. The Chinese banks are all among the largest banks in the country. Another eight banks have a membership in seven FMIs, and 76 banks have a membership in four FMIs (Figure 3).

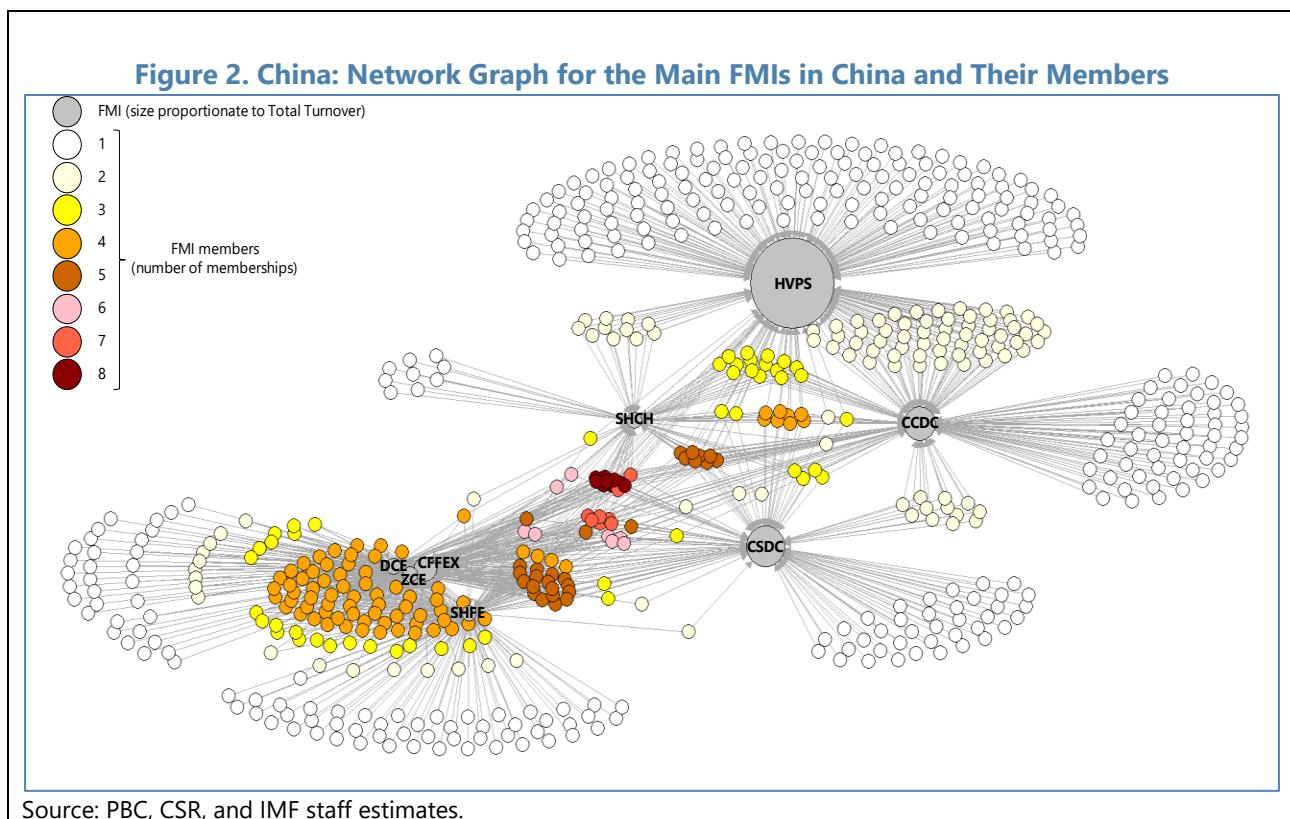


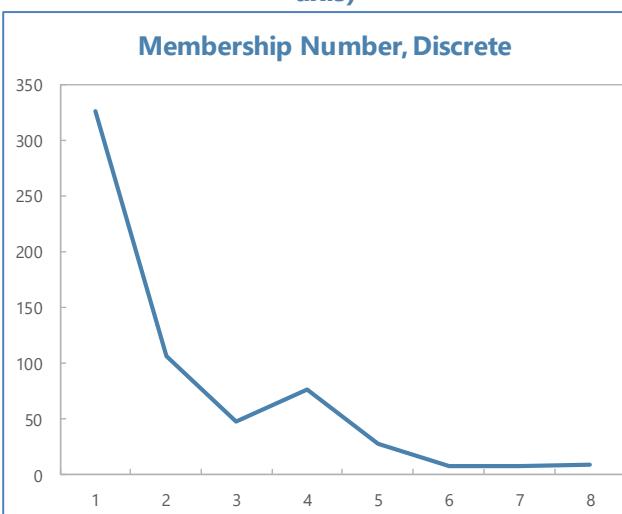
Table 3. China: Overlapping Members between FMIs
 (At a consolidated level)¹

	HVPS	CCDC	SHCH	CSDC	CFFEX	SHFE	ZCE	DCE
HVPS	100%							
CCDC	39%	100%						
SHCH	21%	28%	100%					
CSDC	13%	30%	53%	100%				
CFFEX	5%	12%	24%	38%	100%			
SHFE	8%	17%	36%	40%	82%	100%		
ZCE	5%	12%	23%	38%	83%	61%	100%	
DCE	5%	13%	25%	39%	86%	63%	91%	100%

Source: PBC, CSRC, and IMF staff estimates.

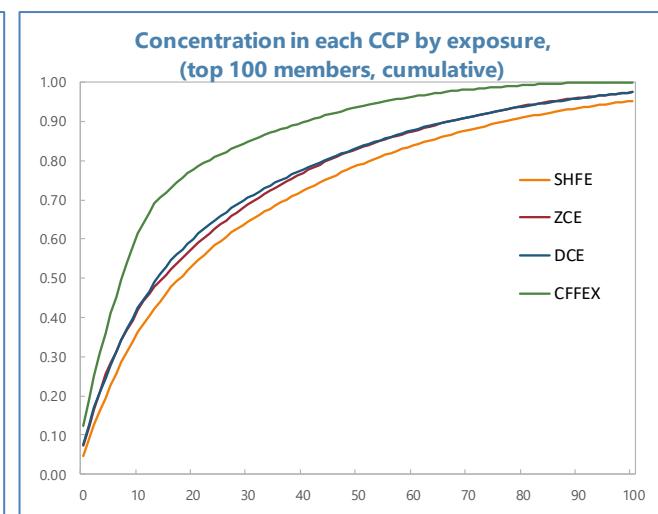
¹ Numbers are for September 30, 2016, except for HVPS and SHCH, for which the dates are December 31, 2016 and November 24, 2016, respectively. The sample of participants contain 609 members, which is a consolidated membership set, based on the top 200 members of the CCDC and all members of the other FMIs. The different members were consolidated at the highest level possible.

Figure 3. China: Number of Members (Y axis) and Their Number of Memberships in FMIs (X axis)



Source: IMF Staff estimates.

Figure 4. China: Percentage of Members Responsible for Exposure of Each CCP



Source: IMF Staff estimates.

55. The network graph further shows the existence of several clusters:

- a. The four futures CCPs have a highly overlapping member base. ZCE and DCE's overlap for more than 90 percent, whereas CFFEX's member base overlaps with the other three futures exchanges for more than 80 percent (Table 3). Turnover and exposures (measured in margin) are somewhat concentrated with approximately a quarter to a third of the member based responsible for 80 percent of turnover and exposure (Figure 4).
- b. CSDC also highly overlaps with the four futures CCPs, with around 40 percent of CSDC's members also being member of these CCPs.
- c. The overlap between members of CCDC and SHCH is more than 50 percent, which may relate to the fact that both FMs are active in the interbank bond market.
- d. The member base of HVPS is more related to those of CCDC and SHCH, illustrating also that CCDC and SHCH settle their cash payments directly in the HVPS.

56. This high interconnectivity suggests that contagion from a financial or operational failure of a FM or critical member could quickly spread through the financial system if proper safeguards are not in place. Data for CSDC and CCDC show that the default of the two participants, and their affiliates with the largest losses, not only affects these FMs, but also other FMs, due to the multiple memberships of these participants. For example, a default of the two participants with the largest exposures in CSDC coincides with the default of these participants in another 5-12 FMs, including several CCPs. For CCDC, the default of the two largest participants (measured in turnover) would coincide with the default of these entities in 4-8 other FMs.

57. This analysis emphasizes the need for: i) resilient FMs that are able to stop a contagion of losses and act as firewalls following the default of one or more participants. This requires full implementation of the PFMI for each FM and a strengthening of the legal framework through the adoption of finality and netting; ii) the need for recovery and resolution planning to ensure the provision of critical operations and services as a going concern, also during extreme circumstances; and iii) crisis preparedness and an ex-ante understanding of how, potentially, losses may spread through the financial system. This underlines the need for cooperation among authorities at a domestic level and an international level as well as joint crisis exercises that simulate the default of operational disruptions at members and FMs. It also requires an ex-ante policy of the PBC with regard to the provision of central bank services, including liquidity support.

Finality and netting

58. Finality and netting are addressed in China at the level of regulations, measures and rules. Since the FSAP in 2011, the PBC, CSRC, and individual FMs have taken measures to define finality and netting in their regulations, notices and rules. Although this is an improvement to the regulatory framework it does not provide watertight protection against a potential revocation of transactions or collateral payments, or an unwinding of netted positions, following the bankruptcy of a bank, as the concepts of finality and netting are not unambiguously included in the Securities

Law, as required by international standards.⁶ Finality and enforceability of netting and collateral arrangements should be at the level of the law, because they *derogate* from the Insolvency statute (a formal law in its own right). A lower level of regulatory norm (or FMI self-regulation) cannot validly and with legal certainty do it. Revocation of transactions, collateral payments or unwinding of positions may result in large liquidity and credit losses and represent systemic risk for FMIs and their members.

59. It is recommended to unambiguously include these concepts in statutory law to provide a high degree of legal certainty for all relevant material aspects covering all FMIs. The legal basis should be strengthened among other things to provide for recognition of settlement finality in the event of insolvency of a participant; recognition of multi-lateral netting; provisions for bankruptcy remoteness of pledged collateral; close out netting; and prescriptions to overcome any zero hour rules. The drafting of new laws, or reviews of existing laws, as discussed under Responsibility A, create a good opportunity to introduce these concepts at a statutory level. Alternatively, authorities may enact a comprehensive statute on finality and netting. This will improve the consistency with the Bankruptcy Law, among others, and also facilitate the determination of Chinese CCPs as qualifying CCPs, or QCCPs, by foreign authorities or banks.⁷

Cyber Resilience of FMIs

60. Authorities have identified cyber risk as an important supervisory topic in relation to financial institutions, including FMIs. A cyber security law was issued in 2016 and will come into effect as per June 2017. The law applies to all critical institutions in China and identifies key institutions in different sectors that are required to take specific measures to protect IT systems and enhance their security level. Within the financial sector the law specifically identifies FMIs as critical institutions for financial stability. In 2016, the CSRC organized an industry-wide contingency test on information security. More than 10 institutions participated in the test, including securities exchanges, futures exchanges, CSDC and market institutions. The test was jointly planned with the Ministry of Industry and Information Technology and the National Energy Administration, and was observed by the Cyberspace Administration of China and the PBC. The exercise tested the emergency response capabilities of the FMIs supervised by the CSRC. The PBC and CSRC have both issued information security requirements, and focus on strengthening the autonomous control of

⁶ The Securities Law articles 120 requires that transactions conducted in line with the trading rules cannot be altered and Article 167 mentions netting. The drafting does not specify that this is unambiguously the case when a member defaults, nor does it specify the point after which a trade is final or irrevocable. There is no mentioning of the protection of netted positions against unwinding, following a member default.

⁷ A qualifying CCP is an entity that is licensed to operate as a CCP, and is permitted by the appropriate regulator/overseer to operate as such with respect to the products offered. This is subject to the provision that the CCP is based and prudentially supervised in a jurisdiction where the relevant regulator/overseer has established, and publicly indicated that it applies to the CCP on an ongoing basis, domestic rules and regulations that are consistent with the PFMI. As is the case more generally, banking supervisors still reserve the right to require banks in their jurisdictions to hold additional capital against their exposures to such CCPs via Pillar 2 (Basel Committee on Banking Supervision, Capital requirements for bank exposures to central counterparties, April 2014).

information systems for the FMs under their respective responsibility.

61. Authorities may strengthen their joint efforts and address cyber resilience explicitly under the PFMI Office. With the promulgation of the cyber security law, cooperation between the PBC, the CSRC and FMs may further improve insights on cyber security and contribute to the awareness and assessments of cyber risks. The CPMI-IOSCO guidance on cyber resilience for FMs may be used as a benchmark.⁸ Joint crisis coordination mechanisms and testing of crisis communication protocols can further improve the management and monitoring of these risks. Where weaknesses were identified, these should be addressed in the PBC's and the CSRC's supervisory activities as a priority.

Recovery, Resolution and Liquidity Support

62. FMs have developed recovery plans. Where some FMs have developed recovery plans in line with international standards, recovery plans of other FMs need further development, beyond business continuity planning and default management.

63. Resolution planning is at an early stage. Resolution planning has the objective to sustain critical operations and services if an FM potentially becomes non-viable as a going concern, while avoiding a bail out at the expense of taxpayers' money. The PBC is studying the features of these arrangements in the Chinese context. So far, no legal framework has been developed, or a resolution authority been appointed.

64. Resilience of FMs can be strengthened through the provision of central bank services to solvent, systemically important FMs. The PBC currently provides settlement services to CCDC and SHCH. It may consider extending these services to the CSDC and other CCPs, under the condition that the FMs strengthen their risk management practices, and, in addition to the CSRC's supervision, are subject to macroprudential oversight of the PBC. Although private sector liquidity must constitute the first line of defense for FMs against liquidity shortfalls, there could be extreme circumstances in which their liquid resources turn out to be insufficient or unavailable. Special financing arrangements could be made by the central bank for the above circumstances to ensure that they can continue to make payments to counterparties and would thereby maintain the stability of the market. Furthermore, the provision of central bank accounts will reduce FMs' dependence on collateral services provided by commercial banks and may also be used for settlement purposes, significantly reducing credit and liquidity risks related to the use of settlement banks.

⁸ Issued in June 2016, <http://www.bis.org/cpmi/publ/d146.htm>.

C. Analysis of HVPS and SHCH

65. This section analyzes the risk management practices of two main FMIs in China, the HVPS and SHCH. Findings and recommendations are based on discussions with the authorities and the two FMIs, as well as the public disclosure document of the SHCH. The HVPS is the RTGS system owned and operated by the PBC, and the SHCH operates a CCP and CSD. It offers CCP services for bonds, OTC traded interest rate derivatives, FX spot and FX derivatives, and freight and commodity derivatives. Appendix 2 and 3 provide more details on the two FMIs.

Analysis of HVPS

66. The HVPS is generally a robust, safe and efficient system with a "V" topology. The HVPS system was upgraded in 2013, with several advanced features. HVPS version 2 features include: (i) liquidity saving offsetting mechanism; (ii) single point access to the participants; (iii) ISO 20022 message formats; and (iv) an increase in operating hours which is 8.30 am to 5.00 pm for normal settlement and 5.00 pm to 8.30 pm for specific business. Further, business continuity and disaster recovery is being enhanced with 3 operating centers in 2 locations (with the 3rd operating center becoming functional this autumn).

67. The PBC Law provides the legal basis for the PBC to operate the HVPS. Article 27 of the PBC Law prescribes that the PBC shall organize, or assist in organizing, a clearing system for banking financial institutions and provide clearing services and in conjunction with the banking regulatory authority under the State Council, formulate rules for payments and settlements. Further, as part of its functions and responsibilities, the PBC under Article 4 (9) is enjoined to maintain the normal operation of the payment, clearing and settlement systems.

68. A dedicated RMC for the HVPS, chaired by the Deputy Governor, is tasked with the responsibility for the overall risk management framework for the HVPS. The heads of relevant departments of the PBC such as the PSD, CNCC, and IT are members of the RMC. Select participants are also invited for the meetings of the RMC, which is held every quarter. All risk related measures pertaining to credit, liquidity and operational risks are discussed during these meetings and action plans for further improvements to the system are drawn up for implementation.

69. Participants in HVPS are divided into direct and indirect participants. There are 305 direct participants and 141,023 indirect participants by the end of 2016. Most of direct participants are commercial banks with RMB reserve accounts at PBC, and the others are PBC's Accounting Department, Treasury Department and FMIs, having direct participant interfaces with HVPS. Indirect participants are other smaller commercial banks (mainly rural) which route their transactions through direct participants for making and receiving payments in the HVPS.

70. Credit risk is largely mitigated in HVPS. Transactions are settled in real time on a gross basis based on availability of funds in the sending participant's account. Secondly, the PBC provides intraday liquidity support to participants on a fully collateralized basis in the form of intraday repos with a fee, thereby mitigating its own credit risk exposure. The intraday liquidity funds have to be

repaid by the participant by the end of the day, failing which it is converted into an overnight facility at a penal rate of interest. Participants tend to use the open market operations (OMO) facility or borrow in the interbank market, for their liquidity needs as these are cheaper sources of liquidity compared to the fee based intraday repo facility.

71. The PBC should review the existing practices related to the fees and the timings of the intraday repo window, and the use of OMO facility. The fee for the intraday repo facility, acts as a disincentive and limits the use of intraday repo by the participants, as it is in addition to the opportunity costs borne by them. Secondly, intraday repo is available only till 5.00 pm, though the operating hours of the system continue till 8.30 pm. The non-availability of the intraday repo facility beyond 5.00 pm could impose liquidity pressures on the participants especially, in times of stressed market conditions.

72. The use of OMO (which is primarily a monetary policy tool), by participants for their intraday liquidity needs in the HVPS, would need to be reviewed and examined by the PBC. Participants either use the OMO facility or borrow in the interbank market, as these are cheaper sources of liquidity compared to the intraday repo facility. Participants could be exposed to liquidity risk pressures if either the OMO is not available on a daily basis or if the interbank market timings do not match with the operating hours of the HVPS.

73. Collateral management practices should be reviewed by the PBC and brought in line with the PFMI. A uniform haircut ratio of 10 percent is imposed on all collateral, which, set in 2004 has not been changed till now. The mark to market module for valuing the collateral on a daily basis, though developed, has not been made operational. In order to mitigate residual credit risk, the PBC should review its haircut methodology and mark to market the collateral on a daily basis. In addition, the haircut methodology and procedures should be subject to an independent validation at least once a year.

74. Enhanced liquidity risk management tools under HVPS version 2, comprise: (i) queuing and settlement of transactions on a First-in-First-out (FIFO) basis; (ii) priority levels for transactions; (iii) use of automated bilateral and operator initiated multilateral offsetting mechanisms; (iv) online queue monitoring by participants and the system operator; and (v) online verification of clearing account balances by participants. Transactions are settled in HVPS using a combination of FIFO and priority levels. Transactions with the same priority level will be taken up for settlement based on the time at which the transaction has been received. The PBC will alert the participants on a queue build-up, but by itself does not change the priority levels; only the participants have the ability to change the priorities of their own transactions.

75. Given the systemic nature of the instant transfers (which are DVP transactions and net clearing settlement files from FMIs), these should be assigned a higher priority in order to mitigate liquidity risk. In the extant framework, instant transfers have the lowest level of priority at priority 7. A rejection of an instant transfer transaction could have unintended liquidity and system-wide risks on participants and other FMIs, given the system-wide dependencies, especially if it were to take place at the end of the day when funding markets may not be in operation and the intraday

repo window is closed. Though the rules specify that the FMI originating the instant transfer is responsible for its settlement, as the system operator, the PBC should take measures to mitigate liquidity and credit risks. Accordingly, these instant transfer transactions should be assigned a higher priority to bring them on par with either priority level 3 or 4 transactions.

76. The PBC should deploy other liquidity risk mitigation tools such as:

- a. **prescribing a cut-off time in the rules of the system**, beyond which a participant cannot withdraw a transaction pending in the queue for settlement, to avoid creating liquidity risks. Currently, participants can withdraw pending transactions at any time during the operating hours, which may cause liquidity pressures for other participants. The rules should accordingly be revised to clearly define the point in time after which unsettled payments may not be revoked by a participant.
- b. **introducing a time varying fee structure**. Participants currently pay a flat fee per payment transfer irrespective of the time at which the payment transfer is sent. Under a time varying fee scheme, participants would pay a lower fee for those payment transfers sent earlier to the system for settlement, while those sent towards the end of the operating hours would attract a higher fee. Such a measure would aid in improving liquidity flows in the HVPS system, and also act as an incentive to participants to submit their payment transfers earlier into the system.

77. The RMC is responsible for the operational risk management strategy of the HVPS which is divided into managing internal and external operational risks. HVPS has a main operating center and a backup center located 300 kilometers away from the main center. A third operating center is coming up in a different location and would start functioning this autumn. The HVPS system functions with a high level of reliability, operational capacity and adheres to the recovery point objective (RPO) and recovery time objective (RTO). HVPS has a holistic business continuity planning (BCP) involving the central system and all the participants including the other FMIs with a crisis and event management component. Apart from the FMIs, around 70 key direct participants (with significant volumes and value of transactions) also have backup centers.

78. A consultative approach is followed by the PBC before effecting any changes to the HVPS rules and regulations. The proposed changes are circulated to the participants and their feedback is elicited and taken into consideration, before the changes are implemented. In addition, HVPS user group meetings are held every six months.

79. HVPS as an FMI, should complete and disclose publicly responses to the CPSS-IOSCO Disclosure framework for financial market infrastructures on a regular basis. The responses to the Disclosure framework should be publicly disclosed both in Chinese and English. It is understood that a self-assessment of HVPS has been carried out, but it should be noted that the self-assessment and the public disclosure of responses to the Disclosure framework are distinct and serve different purposes with different objectives.

Analysis of SHCH

Generally, risk management practices of the SHCH are well designed, and in line with the PFMI. Nevertheless, the mission found several issues of concern that would benefit from further development to align SHCH fully with the PFMI. The SHCH has modern risk management systems, a risk management department, a risk management committee, and a set of responsibilities, rules, procedures and practices to manage both operational and financial risks. Several issues for improvement, identified by the mission, are described in the following paragraphs.

80. The risk-management governance should be further strengthened by appointing an independent chair for the RMC. Currently, the Chairman of the Board of Directors also chairs the RMC, which does not support an independent analysis of risks within the RMC. The Chairman of the Board of Directors may include 'business' considerations in the risk assessment of the RMC. It is therefore recommended to appoint a sufficiently knowledgeable person as chair of the RMC, who is independent of the SHCH's executive management, and who leads independent risk analysis and subsequent reporting to the Board of Directors. This construction allows the Board to receive complete and unbiased information about the risks faced by the SHCH and the management of those risks and balance these against business considerations. Independent reporting enables board members to exercise objective judgment after fair consideration of all information and views.

81. Operational and IT risks should be regularly reported to the Chief Risk Officer (CRO). Currently, the risk management department is the only department within SHCH that reports to the CRO. As the risk management department 'only' covers the management of credit, liquidity and market risks, other risks, such as operational and IT risks, are not regularly reported to the CRO. It is recommended to address this, preferably by having the risk management department also cover operational and IT risks. Alternatively, staff of the Operational and IT Departments that are responsible for risk management should have a direct reporting line to the CRO. The CRO reports all types of risks to the RMC through his/her direct reporting line.

82. SHCH has defined exposure thresholds per clearing member, which may result in uncovered exposures for the CCP and can therefore not be part of SHCH's risk management approach. SHCH monitors its exposures towards clearing members during the day. If, due to new positions or market volatility, a clearing member's exposures are not fully covered by collateral, SHCH does not necessarily call for intraday margin. Instead, it has defined thresholds per clearing member, and will only call for intraday margin if these thresholds are reached. This means that, during the day, the CCP may be exposed to credit risks. The requirement of Principle 4 that 'current and potential future exposures to each participant should be fully met' is not fully implemented by SHCH. SHCH's initial margin calculation should be further developed to ensure that its potential future exposures are covered with a single-tailed confidence level of 99 percent.

83. SHCH does currently not apply a haircut to cash collateral. Only the CCP service for FX spot and derivatives transactions accepts foreign currency, i.e., USD. USD collateral currently comprises only a small part of all margins. Nevertheless, it is recommended to adopt haircuts for

cash collateral in line with the PFMI and international practices to protect the CCP against potential fluctuations in the exchange rate.

84. SHCH's margin and collateral models should be subject to independent validation. The credit risk models, including the margin and haircut models, are not validated by reviewers that are sufficiently independent. Validation of the models should be performed by personnel with sufficient expertise, who are independent of the personnel that created and use the models. These experts could be drawn from within SHCH. However, review by external experts, such as academics or consultants, is also possible. Independent validations should take place at least annually.

85. Liquidity stress testing needs to take place daily. Currently, SHCH conducts liquidity stress tests on a quarterly basis. In line with Principle 7, SHCH must be able to effect intraday and multiday settlement and meet other payment obligations on time under a wide range of potential stress scenarios. To that purpose the FMIs should be able to conduct liquidity stress testing on a daily basis.

86. BCP is well-developed; however, it is recommended to deploy a hot backup site and continue developing BCP arrangements. Apart from the main operational center in Shanghai, SHCH has a disaster recovery site in Shanghai and in Beijing. BCP plans are developed and regularly tested. While the backup sites can take over the IT operations, operational staff needs to be transported from the primary to the secondary site. Also, testing does not necessarily test the full load of operations at the backup site. It is recommended to further strengthen the BCP, for example, through full and regular switching of all operations between the primary and secondary sites and the establishment of a hot backup site.

87. Finally, SHCH may increase the number of liquidity providers and settlement banks for foreign currencies to reduce potential disruptions in case one of these supporting banks fails. SHCH has contracted 2 banks as liquidity provider for USD liquidity needs and 2 banks for credit lines in other currencies. Furthermore, SHCH has selected 2 settlement banks for USD settlements and 1 for other currencies. It is recommended to increase the number of liquidity providers and settlement banks for non-RMB to mitigate concentration risks and interdependencies. This is important as the default of one of these banks may significantly impact SHCH, and its ability to fulfil its obligations as a CCP. For example, in times of stress, one of SHCH's liquidity providers may default, resulting in no or reduced access to credit lines, causing potentially significant liquidity risk to SHCH. The loss of a settlement bank exposes SHCH to operational problems.

Appendix 1. 2011 FSAP and CPMI-IOSCO Implementation Monitoring Assessment Results

2011 FSAP Summary of Main Recommendations

- Complete the legal and regulatory framework through: (i) enactment of a payment system law to give full protection to settlement finality and netting arrangements; (ii) interpretation of the "Enterprise Bankruptcy Law" to avoid a "zero-hour rule"; (iii) upgrade of payment systems rules and procedures to the level of PBC regulation.
- For derivatives clearing and settlement, develop a statutory law containing provisions on derivative trading including among other issue, the enforceability of trades, finality, netting, novation, investor protection and collateral protection.
- The PBC should clarify in detail its policy stance in payment system oversight in a publicly available document, which would expand on the scope of its actions and its plans to achieve its public policy objectives in payment system matters.
- Although a high-level cooperation framework among relevant authorities does exist, structure cooperation for CCPs and CSDs at the technical level more formally. Authorities should also further foster cooperation between them and the private sector and other relevant stakeholders by creating an appropriate forum to discuss payment and settlement matters.
- For CCDC, separate clearly the oversight function of the PBC, the other supervisory tasks of CBRC and MOF, and the operational responsibility of the PBC.
- Upgrade links between CCDC and CSDC to enhance connectivity among Interbank Bond Market, Shanghai Stock Exchange (SSE), and Shenzhen Stock Exchange (SZSE), support further development, and contribute to efficiency in all three markets.

CPMI-IOSCO Implementation Monitoring Results

CPMI-IOSCO Implementation Monitoring Level	Assessment results for China	Publication
Level 1 - Assess whether a jurisdiction has completed the process of adopting the legislation and other policies that will enable it to implement the principles and responsibilities;	The Chinese jurisdiction has the highest ratings in all categories, meaning that final implementation measures are in force for all types of FMs, both for the Principles as well as the Responsibilities.	CPMI-IOSCO 'Implementation monitoring of PFMI: Third update to Level 1 assessment report', June 2016
Level 2 - Assess whether the content of new legislation and policies is complete and consistent with the principles and responsibilities;	Not available for China.	
Level 2/3 - Assess whether the content of new legislation and policies are complete and consistent with the responsibilities and implemented by the authorities;	The Chinese jurisdiction is found to observe all responsibilities.	Draft CPMI-IOSCO 'Assessment and review of application of Responsibilities for authorities', November 2015

Appendix 2. Description of FMI Landscape⁹

Payment Systems

The PBC has developed several interbank payment systems, which include:

- The High-Value Payment System (HVPS): Established in 2005, the HVPS mainly handles inter-city and local credit transfers above a given value as well as urgent low-value transfers electronically. Payment instructions are sent in real time and cleared transaction by transaction. The payments system backbone currently operates in a decentralized way (multi-entry point) with access points in each of the 32 provinces, autonomous regions and cities having province-level status. The HVPS system is interconnected to many trading, payments and securities settlement systems to allow for central bank money settlement.
- The Bulk Electronic Payment System (BEPS): deals mainly with local and non-local paper-based debit payments as well as low-value credit transfers below a given value. In June 2006, BEPS was put into operation nationwide. The system sends payment instructions in bulk, nets in real time and settles at regular times.
- The Cheque Imaging System (CIS): a check truncation system supporting the use of checks nationwide. The CIS system enables electronic exchange of check images, automated clearing of the exchange “paper” instruments and multi-lateral net settlement of the exchange instruments at the HVPS. The system was launched in June 2007 and is available nation-wide.
- The Internet Banking Payment System (IBPS): handles mainly interbank retail payment transactions via the internet, enabling customers to submit online payments and obtain results in real time. IBPS has been put into operation nationwide since August 2010.
- The China Domestic Foreign Currency Payment System (FCPS): this is an RTGS system developed by the PBC for the foreign currency payments incurred by domestic purchases of goods and services. It was put into operation at the end of April 2008. FCPS can process payments in eight currencies: USD, HKD, GBP, EUR, JPY, CAD, CHF and AUD. It does not involve foreign exchange transactions.
- The China's Cross-border Interbank Payment System (CIPS): a RTGS systems that provides both onshore and offshore banks a central location for clearing renminbi payments and is directly linked to China National Advanced Payment System (CNAPS).

All these payment systems are owned by the PBC. HVPS, BEPS and IBPS are the three primary application systems of the CNAPS. In addition, there are numerous check clearing houses around the country administered by the PBC local offices or delegated to banks when the locality has not a PBC branch. China Union Pay handles the clearance of cards transactions whose balances are settled in the HVPS. Two other ACH's are i) the Clearing Center for City Commercial Banks, owned by City

⁹ Based on the CPSS Redbook China, 2012, and discussions held during the mission.

Commercial Banks; and ii) the Rural Credit Banks Funds Clearing Center, owned by 30 Rural Credit Banks.

Central Counterparties (CCPs)

- The China Securities Depository and Clearing Corporation Limited (CSDC) provides stock exchange markets with such services as centralized registration, custody, clearing and settlement. It delivers multilateral netting services as a CCP, as well as securities and funds settlement services as an operator of the securities clearing and settlement system. The CSDC is owned by the Shanghai Stock Exchange (50 percent) and the Shenzhen Stock Exchange (50 percent). Both stock exchanges are member owned entities.
- The Shanghai Clearing House (SHCH) is the CCP for bonds, OTC traded interest rate derivatives, FX spot and FX derivatives, and freight and commodity derivatives. SHCH provides netting and centralized clearing services in RMB and foreign currencies as well as for cross-border transactions in RMB approved by the PBC. SHCH is owned by the China Foreign Exchange Trade System (46.67 percent), CCDC (33.33 percent), the China Banknote Printing and Minting Corporation (10 percent), and the China Gold Coin Incorporation (10 percent). These four entities are, on their turn, all owned by the PBC and/or the State.
- In addition, there are four main futures exchanges, which all have their own in-house clearing and settlement arrangements, including CCP services. The three commodities exchanges are the Shanghai Futures Exchange (SHFE) (copper, aluminum, zinc, steel wire rod, rebar, natural rubber, fuel oil, and gold), the Dalian Commodities Exchange (DCE) (soybean, corn, polyethylene, palm oil and PVC) and the Zhengzhou Commodities Exchange (ZCE) (wheat, cotton, sugar, rapeseed oil, and rice). The China Futures Exchange (CFFEX) clears financial derivatives traded on its exchange platform. All futures exchanges are member owned entities.

Securities Settlement Systems (SSS) and Central Securities Depositories (CSDs)

- China Central Depository & Clearing Co., Ltd. (CCDC) provides services such as issuance, registration, custody, settlement, redemption and information products for the bond market. It is the only institution entrusted by the MOF to be the depository for Government securities and has linkages with the Open Market Operations System of the PBC. The CCDC is fully owned by the MOF.
- SHCH registration and settlement system SHCH provides participants in the interbank bond market with registration and settlement services for warrants and commercial paper subject to the regulation of the PBC. SHCH is owned by the China Foreign Exchange System (46.67 percent), CCDC (33.33 percent), the China Banknote Printing and Minting Corporation (10 percent), and the China Gold Coin Incorporation (10 percent). These four entities are, on their turn, all owned by the PBC and/or the State.
- The securities settlement system of CSDC provides settlement services for transactions in securities listed on the Shanghai and Shenzhen stock exchanges, concerning stocks, funds, warrants, treasury bonds, local government bonds, corporate bonds and convertible bonds, etc.,

as well as for the Exchange bond market. Government securities can also be traded in the stock exchanges. For this purpose, the CSDC holds an omnibus account at the CCDC and beneficial owner securities settlement for stock exchange transactions is done through CSDC's books (Figure 1).

Appendix 3. Statistics of FMIs

**Table 1. China: Key Statistics FMIs
(2014)**

	<i>(millions, total for the year)</i>	<i>(CNY billions, total for the year)</i>	<i>(end of year)</i>	<i>(measured for value of trades)</i>
	Number of trades	Value of trades	Number of participants	Their rank worldwide
Payment Systems				
HVPS	712	2,346,893	131,653	#4 out of 65
BEPS	1,435	22,075	131,522	#37 out of 65
Exchanges				
Shanghai SE	1,742	128,149	258	#5 out of 39
Shenzhen SE	1,851	44,470	120	#11 out of 39
CCPs (data for 2010)				
CSDC	3,106	63,937	220	#6 out of 38
CSDs				
CSDC	3,890	251,625	nap	NA
CCDC	1.13	244,541	6,681	NA

Source: CPMI, Statistics on payment, clearing and settlement systems in the CPMI countries.

**Table 2. China: Trading Volumes and Global Rank for Chinese Derivatives Exchanges
(2015)**

Exchange	Title	Value (USD millions)	Value (CNY millions)	Exchange Total Value (USD millions)	Exchange Total Value (CNY millions)	Worldwide Exchange Rank (2015)
CFFEX	Treasury bond futures	950,709	6,010,675	67,587,209	417,760,470	#5
	Interest rate options					
	Stock index futures	66,636,500	411,749,795			
	Single stock index options					
DCE	Commodities options			6,698,390	41,935,973	#19
	Commodities futures	6,698,390	41,935,973			
SHFE	Commodities futures	10,148,100	63,555,263	10,148,100	63,555,263	#15
	Commodities options					
	Value of share trading					
ZCE	Commodities futures	4,944,870	30,805,485	4,944,870	30,805,485	#22
	Commodities options					

Source: World Federation of Exchanges, CSRC.

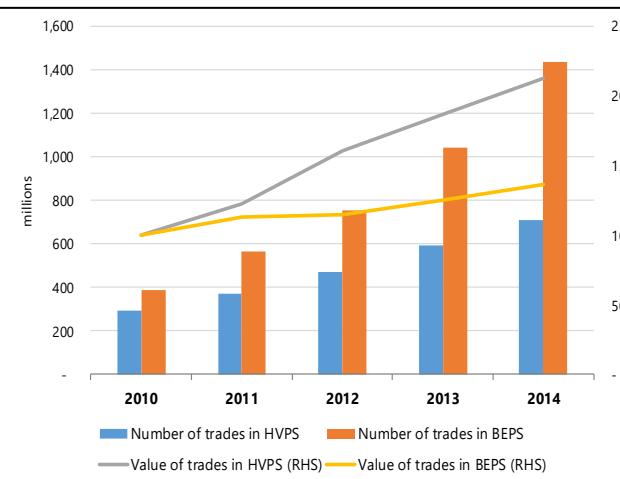
Table 3. China: E-money Instruments

		2013	2014	2015
E-money instruments	volume (10 thousand)	2,578,316.77	3,333,286.81	10,523,315.16
	value (100 million Yuan)	10,751,606.11	14,046,457.77	25,062,261.90
Internet	volume (10 thousand)	2,367,418.50	2,857,446.97	3,637,133.31
	value (100 million Yuan)	10,607,832.04	13,760,202.94	20,182,100.53
Phone	volume (10 thousand)	43,466.39	23,444.10	29,841.89
	value (100 million Yuan)	47,394.04	60,391.12	149,891.54
Mobile	volume (10 thousand)	167,431.88	452,395.74	1,383,635.13
	value (100 million Yuan)	96,380.04	225,863.70	1,082,161.85
Others	volume (10 thousand)			1,082,085.56
	value (100 million Yuan)			2,376,390.46

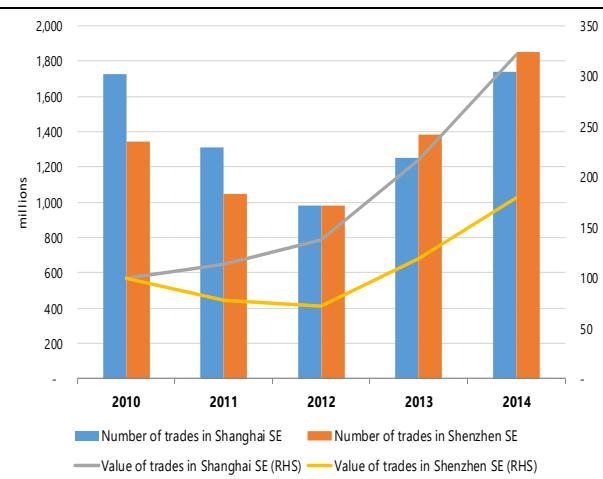
Source: PBC.

Figures

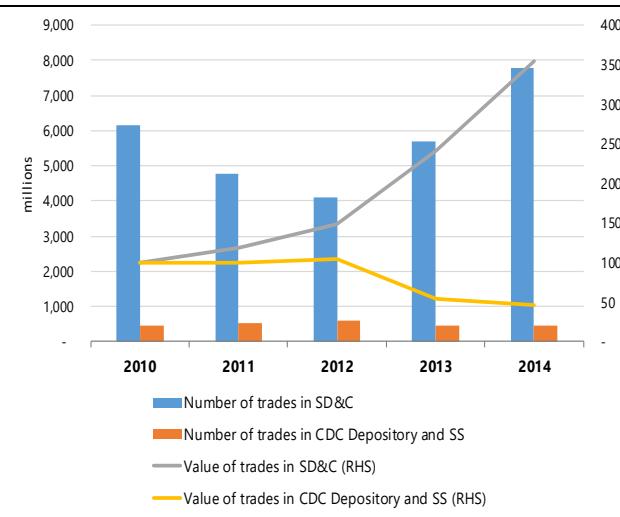
Key Payment Systems, Number and Value of Transactions, 2010-2014



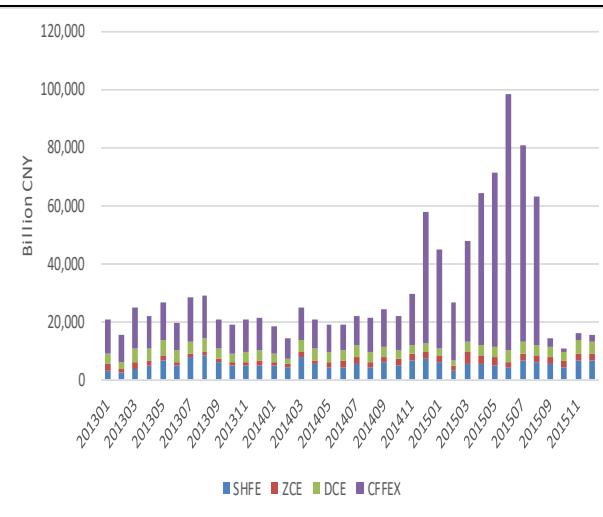
Key Stock Exchanges, Number and Value of Transactions, 2010-2014



Key Stock Exchanges, Number and Value of Transactions, 2010-2014



Turnover Derivatives Exchanges, Value of Transactions, 2013-2015



Source: CPMI, Statistics on payment, clearing and settlement systems in the CPMI countries. CSRC. PBC.

Appendix 4. Systemic Risk Indicators Domestic FMIs

	Daily settlement value 2015, billion RMB (percent of GDP)	Nr. of members (November 2016)	Critical for other FMIs	Potential substitute	Type of markets served	Other critical functions
Main payment systems						
HVPS	11,761 (16 %)	305	CCDC, CSDC, CIS (indirect other FMIs)	One or more commercial banks	All interbank transactions	Monetary policy operations
CIPS	0.0 (0.0%)	28	-	One or more commercial banks	Interbank retail trades	
BEPS	68.67 (0.1%)	305	-	HVPS	Interbank retail trades	
CIS	1236.74 (1.6%)	2,170	-	BEPS	Interbank retail trades	
IBPS	76.57 (0.1%)	174	-	HVPS	Interbank retail trades	
FCPS	Few millions	51	-	One or more commercial banks	FX interbank trades	
China union Pay	136.13 (0.2%)	1639	-	One or more commercial banks	Card payments	
Clearing Center for City Commercial Banks	1.49 (0.0%)	100	-	One or more commercial banks	Corporate and retail transactions	
Rural Credit Banks Funds Clearing Center	9.94 (0.0%)	67	-	One or more commercial banks	Corporate and retail transactions	
CSDs						
CCDC	3,509 (5.1%)	2,812	Collateral management for CCPs	SHCH	Interbank bond market	Monetary policy operations; collateral management
SHCH	326.06 (0.4%)	86	Same as CCDC	CCDC	Interbank bond market	Collateral management
CSDC	2067.65 (2.7%)	142	Same as CCDC	CCDC/SHCH	Equity market	Collateral management

CCPs						
CSDC	2067.65 (2.7%)	142	-	One of the other CCPs	Equity market	-
SHCH	167.41 (0.2%)	86	-	-	OTC derivatives, bond and FX markets.	-
ZCE	122.71 (0.2%)	151	-	One of the other CCPs	Commodity derivatives	-
DCE	166.53 (0.2%)	164	-	One of the other CCPs	Commodity derivatives	-
SHFE	253.31 (0.3%)	202	-	One of the other CCPs	Financial and commodity derivatives	-
CFFEX	1664.46 (2.2%)	147	-	One of the other CCPs	Financial derivatives	-