

# International Monetary Review

March 2014, Vol. 1, No. 1

**Chen Yulu**

Changes in International Trade Structure and the Internationalization of RMB

**International Monetary Institute**

The Dynamics and Outlook for RMB Internationalization—Report on RMB Internationalization, Q1/2014

**He Qing**

Recent Macroeconomic Stability in China

**Liu Xiangbo**

Inflation and Economic Growth: A Hump-Shaped Relationship

**Gang Jianhua and Qian Zongxin**

Monetary Policy and Systemic Risk in China

Also including

*Making Europe Work* by Robert Mundell

*China: Money Matters* by Steve H. Hanke

*China's Exchange Rate and Financial Repression: The Conflicted Emergence of the Renminbi as An International Currency* by Ronald McKinnon and Gunther Schnabl

*The Future of the Monetary System of Hong Kong* by Joseph Yam Chi Kwong

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## Introduction to the International Monetary Institute (IMI)

Established on December 20, 2009, IMI is a non-profit academic institution affiliated to China Financial Policy Research Center and the School of Finance of Renmin University.

Following the "general theory of macrofinance", IMI aims to become a world-class think tank, focusing on the studies of international finance, in particular the international monetary system and RMB internationalization. Despite its relatively short history so far, IMI has established itself as a leading research institution and important forum, where industry leaders, policy makers and academic experts from home and abroad share their insights and expertise.

# CHEN YULU

President of Renmin University of China

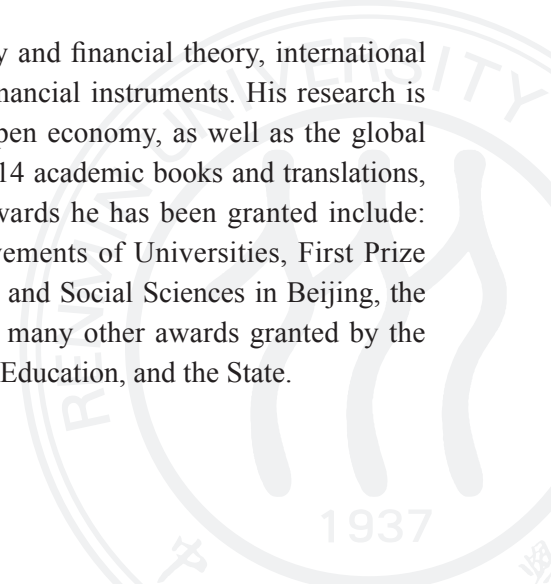
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Prof. Chen Yulu was born in Hebei Province in November, 1966. He is a professor in the School of Finance, Renmin University of China. He is the chairman of the Academic Committee of International Monetary Institute of Renmin University. He has a Ph. D. in Economics, and is a Ph. D. supervisor. He has been a senior fellow of Eisenhower Foundation, and a Fulbright scholar at the University of Columbia. He is now President of Renmin University of China. He is also Deputy Director of the Chinese International Finance Society, and Deputy Secretary-General and Executive Director of Chinese Monetary Society. He was listed in the “New-Century National Experts” Project commissioned by the Ministry of Personnel in 2004, and is receiving a special government subsidy from the State Council. He was awarded the “College Young Teacher’s Prize” by the Ministry of Education, and also awarded for supervising the Excellent Doctoral Dissertation.

Professor Chen Yulu worked as a teacher in the Department of Finance, Renmin University of China, from January 1989 to June 1992. He was Deputy Director and Lecturer from July 1992 to January 1993, Deputy Director and Associate Professor from February 1993 to April 1997, Vice Dean and professor from May 1997 to January 2002, and Dean from January 2002 to May 2005, Vice President from May 2005 to March 2010. From March 2010 to October 2011, he was the president at Beijing Foreign Studies University. He has been the president of Renmin University of China since November 2011.

Prof. Chen’s academic interests are monetary and financial theory, international finance, corporate finance and fixed-income financial instruments. His research is mainly on financial theory and policy in an open economy, as well as the global capital market. His recent publications include 14 academic books and translations, and dozens of papers. The major academic awards he has been granted include: First and Second Awards for Research Achievements of Universities, First Prize for Excellent Scientific Research in Philosophy and Social Sciences in Beijing, the Eighth An Zijie International Trade Prize, and many other awards granted by the Beijing Municipal Government, the Ministry of Education, and the State.



This issue is proud to present



陈雨露

CHEN YULU

President of Renmin University of China

Chairman of IMI Academic Committee

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## In Brief

### Editor's Note:

*Up to the end of the first quarter of 2014, the advisory board members and academic committee members of IMI have been expressing their research opinions on monetary finance and economics through published articles and public speeches. The following is a summary of their research reviews.*

### Research Review by IMI Advisory Board Members



In his speech in Columbia University, **ROBERT A. MUNDELL** gave his opinion on the crisis of the Eurozone and some alternative paths that political reform could take. His key conclusions were summed as the following: great benefits could be achieved by the creation of a European Ministry of Finance with authority over the spending and deficits of the nation states; great gains could be got for the euro area by the creation of Eurobonds and Eurobills with ceilings on government spending and deficits; and the centralized fiscal authority should be put into place at an early date, then followed Eurobonds, and in the interim, the ECB's firepower and tools for maintaining price stability could be built up.

European Central Bank seemed to be "forced" by the foreseeable breakup of Eurozone to intervene when interest rates rise above the dangerous line of 7%, but the problem was that the amount of intervention might conflict with the ECB's mandate to give priority to macroeconomic stability and in particular inflation rate stability. Mundell criticized that the ECB had been erring substantially on the



side of being too tight in the context of the de-leveraging crisis, and some degree of expansionary monetary policy could be a necessary solution to Europe. Despite the well-known inflation-averting reason of ECB's mandate, some risks have to be taken to avert insolvencies, which could result in higher inflation than otherwise. Mundell suggested a temporary movement up of inflation targets, which could relieve the situation and start a speedier recovery in the euro area.

To deal with the possibility that the monetary expansion resulting from support for a particularly weak national bond market exceeded the rate needed for inflation, he suggested that the ECB could issue its own "ECB bonds" to keep "bailout policy" in line with monetary stability, in effect to sterilize the monetary effects of bailout policy. In essence, ECB bonds are debts of the European Union, and eventually when Europe creates its own Eurobonds these ECB bonds could be absorbed into the debt of the EU. But the ECB bonds could be useful instruments during the transition period before Eurobonds and Eurobills are established.

**STEVE H. HANKE** in his article "*China: Money Matters*" mentioned, contrary to what the doomsters have been telling us, China's economy is not on the verge of collapse. As the Wall Street Journal's man in Beijing (and my former student), Aaron Back, reported: "China's economic growth accelerated in the fourth quarter of 2012." Indeed, China's fourth quarter GDP growth rate came in at a strong 7.9%. What the doomsters and many other Pekingologists fail to grasp is that money matters. Indeed, it dominates fiscal policy, and nominal GDP growth is closely linked to growth in the money supply – broadly measured. China's most recent acceleration in GDP growth did not catch me flatfooted, because China's money supply has been surging (see the accompanying chart). In fact, China's M2 money supply measure is 9.7% above the trend level. Money matters.







**RONALD MCKINNON and GUNTHER SCHNABL\*** pointed out in their article “*China’s Exchange Rate and Financial Repression: the Conflicted Emergence of the Renminbi as an International Currency*” that the dollar standard has contributed to substantial distortions in the world economy in recent decades. Governor Zhou Xiaochuan of the

People’s Bank of China argued in his speech entitled *Reform the International Monetary System* that the ongoing financial crisis was aggravated by inherent weaknesses of the current international monetary system based on a single national currency—the dollar. But private firms and banks have found it indispensable for reducing the cost of their international transactions by building up huge official dollar reserves, despite complaining about using a purely national currency as international money.

Considering the poor monetary performance by the U.S. Federal Reserve Bank, one would tend to predict that a rival national money would develop as another world’s key currency. That would certainly be true if high inflation developed autonomously in the United States; then substitution could be quite rapid, and the Renminbi would be a candidate for replacing the dollar—not only in Chinese trade but beyond.

But if poor American monetary management takes the form of near zero interest rates in the U.S. that is followed by the other industrial countries, an emerging market like China is prevented from liberalizing its own financial markets sufficiently for the Renminbi to become a contender as the world’s key currency. At most, China is limited to encouraging greater invoicing of its own foreign trade in RMB. But purely financial transacting in RMB is best kept resolutely “offshore” to avoid China being inundated by hot money from abroad.

Regarding the emergence of Renminbi as an international currency,

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the near-zero interest rate trap in the financial markets of mature industrial countries essentially limits the possibilities for successful financial liberalization in China in order to “internationalize” the RMB. Thus China, and possibly other emerging markets, will just have to live in dollar-based world with capital controls and incomplete domestic financial liberalization.

On the bright side, through foreign trade under the dollar standard, China has had the world’s fastest growing economy for more than three decades. That could be jeopardized by an unwise lurch to full foreign exchange liberalization on capital account. But liberalization or not, stabilizing the yuan/dollar rate is best for an uncomfortable situation.

**JOSEPH YAM CHI KWONG** proposed in his paper “*The Future of the Monetary System of Hong Kong*” a forward-looking change for the monetary system, which has been effectively operated under Linked Exchange Rate over the past thirty years. He frankly raised the questions as whether the current monetary system of Hong Kong can continue to serve the public interest in the best possible manner, and if not what modifications should be introduced so that Hong Kong can maintain its status as an internal financial center with the changing external environment. He addressed the important issues in shaping the future of the monetary system respectively from the legal, monetary, technical and political perspectives.



As discussed in his paper, the legal framework allows the central bank to exercise discretionary monetary management to achieve traditional monetary policy objectives, and HKMA is technically capable to control the supply and the price of the domestic monetary base. Supplemented with plentiful researches, the prospects of quickly establishing policy and institutional credibility are good. Considering the relatively small jurisdiction of Hong Kong, a financial infrastructure that allows transactions to be conducted in currencies subject to the chosen of fund raisers and currency risks to

be managed by overseas investors is essential in maintain the financial status and stability of Hong Kong. Technically, it will be desirable to unify the two different convertibility undertakings. If exchange rate flexibility are approved, the convertibility zone could be meaningfully widened, removed, or be turned into a corridor for the exchange rate. It is also possible to remove an exchange rate target or zone, and focus in managing the domestic monetary conditions to achieve the defined monetary policy objectives. The political considerations are complex; but hopefully all involved would be guided by what is in the best interest of Hong Kong.

## Research Review by IMI Academic Committee

### Members



According to the article “*The Change in International Trade Structure and RMB Internationalization*” by **CHEN YULU**, as the RMB was more accepted in international trades, international financial transactions and official exchange reserves, the Renminbi Internationalization Index (RII) climbed to a new high. The RII in Q4/12 reached 0.87.

Since the beginning of this century, great changes have taken place in the world trade structure, and some new characters have shown. First, emerging markets played more and more roles in global trade. Currently, the international trade volumes of emerging economies are well matched with developed nations. Second, multilateral negotiations in the globalization of international trade are gradually replaced by regional and bilateral arrangements. In addition, as trades are more and more related with finance, disputes in international trades are extended to economic policies.

Theoretically, international trade structure and international monetary architecture are inter-related. Normally, the change in international trade structure will result in the adjustment of the international monetary architecture. Only by establishing

multi-currency pattern along with the current world trade and prompting the return of international reserve assets to the original function of maintaining the ability to pay for major creditor, can we expect to break the "new Triffin dilemma". In this sense, the RMB internationalization shoulders significant historical mission. China should seize the opportunity of world trade pattern adjustment and actively promote the RMB internationalization. We should take full advantage of regional trade to raise the share of RMB for trade settlement in the majority of emerging economies and treat that as the focus of monetary internationalization policy at this stage. Moreover, through direct investment in RMB, the RMB capital outflow of foreign credit and other ways, we can improve the share of RMB-denominated settlement. In other words, we should spare no effort to create opportunities for domestic and international trade-related activities selecting RMB-denominated settlement.

In his article "*Accelerating to Formulate the Macro-finance Strategy of China*", CHEN YULU pointed out in the 8<sup>th</sup> session of G20 leader summit, leaders from China and other countries discussed the further improvement of global governance, especially through reforming IMF, World Bank and other relevant organizations, to promote a more rational and efficient international economic order. China should take this opportunity to adopt the Macro-finance strategy and thereby obtain more say and exert more influence in international trade and economy. At present, the fast growth under our traditional economic pattern is no longer sustainable. Therefore, in the coming 5 years to 10 years, we should undertake an array of reforms to transform our economic development pattern. To this end, the development of China's financial sector should focus on building the foundations for theories, values, and practices. Once integrated, the three foundations will become the theoretical pillar and core value system for Macro-finance strategy.

Under this framework, the blueprint for the development of our financial sector and the way to implement the blueprint can be summarized as internal development, external development, and macro-management. First, internal development requires the construction of a high-efficient and stable system for modern

financial industry and the effective integration of financial sector and real economy. Second, the major goal of external development is to open our financial sector to the outside world in an active yet prudent fashion. Therefore, we need to consider both efficiency and stability and strike a proper balance. Last, the major goal of macro-management is to establish and improve financial regulation system and enhance the early warning for financial imbalance.

In conclusion, the above-mentioned blueprint for China's financial development covers almost all the basic problems and policy issues facing our financial sector. And the choice of implementation approaches combines the general pattern of financial development with our "national endowment". These enable us to strike a dynamic balance between efficiency and stability in the reform and development of our financial sector.

Based on "*The Future of RMB Globalization*" by CHEN YULU, TU YONGHONG and WANG FANG\*, since 2009 when we started cross-border RMB settlement in 5 pilot cities including Shanghai, the Globalization of RMB has witnessed major breakthroughs in policies and institutional restrictions and the development of RMB offshore market and RMB globalization has accelerated. The globalization of RMB is now faced with important historic opportunities: China's rise consolidates the economic foundation for RMB globalization; the growth of developed countries slows down, which damages the credit foundation of their currencies. This change in external environment undoubtedly brings an important opportunity to RMB globalization; the reform of international currency system grants China more say; the huge amount of forex reserve is a credit guarantee for RMB globalization; and the inclusiveness of Chinese culture enhances RMB's soft power.

RMB globalization is a major reform to the current international currency system. As RMB globalization has just started, it is faced with both daunting internal and external challenges. First, the fragility of our economic growth model and economic structure undermines market confidence. Second, inefficient financial system and non-market-based interest rate hinder the progress. Third,

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arbitrage in offshore RMB market undermines the effect of our monetary policies. Fourth, capital account control compromises the integrity of RMB as a world currency. Fifth, we still have a long way to go before we conquer the “inertia” of international currency system.

To address those challenges, we propose the following policy suggestions. First, the biggest long-lasting challenge for RMB globalization comes from our real economy. Second, our problematic financial institution, under-marketized financial market, and inefficient financial system make RMB less attractive and competitive in the global market. This is a mid-term challenge for RMB globalization. Third, offshore financial market is the core for contemporary international finance. Without the support from a certain scale of RMB offshore market, the globalization of RMB will remain at low levels. Fourth, it is very important to keep our mind cool. We should not promote RMB globalization through fervent campaigns.

In his speech “*An Outlook for the Challenges and Opportunities of China’s Banking Sector*”, **BEN SHENGLIN** indicated that China witnessed a four-fold increase in its banking sector and improvement in banks’ profitability from 2003 to mid-2012. As the market situation continuously changes, the future challenges and opportunities are also changing in three aspects: marketization, internationalization and intellectualization. The challenges are: in the financial sector, no one always wins; non-bank financial intermediaries such as the shadow banks are nibbling the market away and facilitating interest rate liberalization; the internationalization of the RMB and financial institutions will accelerate, and the RMB may become a currency for reserves and investment; our profit models may not be sustainable; the development of intellectualization, especially in terms of payment and settlement; risk control. The opportunities are: we can further develop the economy only by developing the real economy and



deepening market-based reform; people's rising income has provided commercial banks with sufficient low-cost working capital; the opportunities emerged from restructuring have prompted commercial banks to carry out strategic transformation; the adjustments to the global financial situation.



**CAO TONG and QU SHUANGSHI\*** pointed in *“Going through the Bottleneck Period in RMB Internationalization”* that the trial of RMB cross-border trade settlement marked the beginning of RMB internationalization. In 2013, RMB ascended as one of the top 10 foreign exchange currencies, which showed the rise of RMB's international position. However, since the development of everything must follow an upward spiral pattern, the internationalization of RMB has come to a bottleneck period following the previous rapid development, which is exactly the case for Hong Kong offshore RMB market. This situation results from the following three aspects: unmatching of the investment and financing system regarding the construction of the offshore markets; the unsettlement of the direction of “RMB District”; the disconnection between the international strategy of state-owned banks and the internationalization of RMB.

In terms of the direction and path of RMB internationalization, we make the following suggestions. The first is to clarify the orientation: conduct the second phase of RMB internationalization following the construction of “RMB District”, and determine the direction of “RMB District” following the strategy of combining the East and the West. The second is to innovate the scheme: promote the system innovation of the Hong Kong offshore financial market, including the construction of RMB bond market and foreign exchange market; promote the construction of RMB settlement, liquidation and credit networks for Association of Southeast Asian Nations (ASEAN) and Central Asia and the west; develop the special function of China (Shanghai) Pilot Free Trade Zone. The third is to gather the strength: China should make a strategic plan for the second phase of RMB

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internationalization; the People's Bank of China should focus on the organization and implementation of the plan; state-owned banks should cooperate with the government and PBC, combine the international strategy and RMB internationalization, and play the role of the market maker in offshore RMB markets.

In the article ***“China Should Adopt Primary Deficit Golden Fiscal Rule”***, **GUO QINGWANG** stated that to address global financial crisis effectively and maintain a stable and fast growth in China, in 2009, the central government adopted a stimulus package with a value as high as 4 trillion yuan for the next two years. Fiscal deficit registered a record high of 950 billion and national debt was estimated to be between 1.4 and 1.6 trillion yuan. Currently, China's growth slows down and therefore national debt again draws attention from the society. Some people analyze the influence of public debt on economy and point out that the size of public debt is in an inverted U relationship with the effect of public debt, which means an optimal debt size exists. Based on that assumption, they launched a comprehensive survey to see whether Chinese government's debts are in a proper size.



After researches, we come to the following conclusions. First, when government is making fiscal policies to ensure long-term growth and fiscal security, it should adopt the concept of “rule”. Second, according to China's current situation, the government should adopt the primary deficit golden rule. Under this rule, primary deficit is financed by taxation and public physical capital investment and interests are financed by issuing treasury bonds. In this way, the rule promotes a long-term growth and improves government's fiscal health. However, of course, even if China adopts such a rule, the central government should be prudent in massive debt financing in case excessive deficit damages the balance and stability of economy. Third, debt interests can be financed by treasury bonds. The treasury bond interests can also be financed by issuing new treasury bonds and this can be achieved through expanding tax base. In this way, tax

rates are held constant (which prevents economic distortion caused by tax rate increase) and productive expenditure is raised. This will boost long-term economic growth and, with deficit being within a proper scale, not have negative impacts on the sustainability of national finance.



**JI ZHIHONG** pointed out in “*Perspectives on China’s Policy through the Ratio of M2/GDP*” that in recent years, the sustained rise of the M2/GDP ratio signifies the marketization of China’s financial industry. This is closely related to China’s economic development mode over time and influenced by statistic scope change of M2 money supply. At the present stage, we should observe China’s policy from

the aspect of transition, strengthen the research of the M2/GDP ratio, and treat the ratio using a dynamic research method. The objectives of China’s monetary policy feature multiplicity. In general, we should strengthen macro-prudential management to maintain the price and financial stability.

**QU QIANG and WANG LEI** stated in “*Reflections on Monetary Credit Theory from Financial Crisis*” that the mainstream monetary credit theory before financial crisis was unable to predict and explain the occurrence of the crisis. The theory has made some new development after financial crisis. We believe that one qualified financial crisis theory should combine the currency, credit and



financial institutions, especially banks, that create credit into a unified framework, in order to explain the circumstances when financial sectors collapse due to the over expansion of credit, create mutual feedback with the real economy, and lead to economic crisis.



According to the article “***Renminbi Internationalization Index (RII): A New Indicator to Measure the True Level of RMB Internationalization***” by TU YONGHONG, restricted by the statistical method of IMF, the international official foreign exchange reserves percentage index cannot measure the internationalization of RMB accurately.

Therefore, Renmin University of China created the RMB Internationalization Index (RII) based on international monetary functions and monetary transaction functions in real economy. RII is a new indicator to measure and reflect the true level of RMB internationalization. As a convenient and effective management tool, RII aims to grasp the complexity in the process of RMB internationalization and the obstacles and driving forces in the development of RMB internationalization. Also, RII facilitates the comparison of the internationalization of the main currencies and lays a theoretical foundation for the diversified reform of the international monetary system and occupies high ground of the media.

The index system of RII sets up corresponding indicators based on the roles that RMB play in financial transactions of direct investment, international securities and international loans and credits. Since each indicator in the system is a ratio itself and there is no difference in order of magnitudes, we do not need to nondimensionalize the indicators and RII can be calculated using weighted average using the following formula:

$$RII_t = \frac{\sum_{j=1}^5 X_{jt} w_j}{\sum_{j=1}^5 w_j} \times 100$$

Where  $RII_t$  represents the RMB international index at time  $t$ ;  $X_{jt}$

shows the value of variable  $j$  at time  $t$ ;  $w_j$  is the weight on variable  $j$ .

An increasing RII demonstrates a higher level of internationalization and more international monetary functions that RMB plays in world economy.

RII increased to 0.87 at the end of 2012 from 0.02 in 2010, increased by 42.5 times in three years, which showed international society's confidence in RMB functioning as an international currency. The internationalization of RMB made important breakthrough in policy and market development. However, compared with international main currencies, the internationalization of RMB is still at a relatively low level. For this, we make the following suggestions: promote international influence of RII by enhancing the index system and availability of data; pay equal attention to the international currencies' function of pricing, account settlement and reserve, and emphasize the transaction function of an international currency; track the types of currencies used in pricing and settlement in import and export by national and international firms.

In his article "*New Change of International Economy and Cultivation of China's Capital Market*", **WEI BENHUA**

indicated that with continuous development of economic globalization, international trade has developed unprecedentedly and economies of countries around the world have been integrated more closely. G20 is pushed to the stage of history by global financial crises, which highlights the leading role of G20 in world economy and trade. Recently, shadow banking emerges in China. According to the international definition, shadow banking is the business which cannot be supervised or controlled by financial regulatory institutions. In order to cultivate and improve China's capital market, we should further improve the legal system and promote the reform in financial sectors.



In the article “*Review and Outlook of Basel Banking Supervision Reform*”, **XUAN CHANGNENG** stated that the Third Plenary Session of the 18<sup>th</sup> Central Committee of the Communist set the goal of deepening the overall reforms. In terms of financial reform, an important mission is to implement the reform measures in financial regulation. In this context, China should participate and try to lead the international standard setting process, promote the implementation and utilization of the standards. The formation and development of the Basel Banking Supervision Framework are the outcomes of reflections and responses to all previous financial crises. On the occasion of the first anniversary of China’s full implementation of Basel III and Rules Governing Capital Management of Commercial Banks (Provisional), it is crucial to review the latest development of Basel banking supervision reform and analyze the deficiency of the current framework, so as to participate in the coordination of international regulation policy and



raise the stability criteria of domestic banking industry.

Since the official release of Basel III, Basel Committee on Banking Supervision has been continuously revising the key regulatory index, improving measurement rules of risk-weighted assets, enhancing the systematically significant banking supervision and activating country assessments under the new capital supervision criteria. While Basel Banking Supervision Framework improves international banking regulation, it is also confronted with many questions and challenges from multiple parties: inadequacy of foresight and initiative of the reform; complication of the regulations due to excessive pursuit of risk sensitivity; reduction of regulatory effectiveness resulting from relaxation of standards and extension of transition period; slow construction speed of the coordination system. In the process of future reform and implementation of Basel Banking Supervision, on one hand, we should adhere to the principle of international financial regulation reform, speed up international regulatory cooperation, balance simplicity, comparability and risk sensitivity, and pay high attention to changes in banks' operational mode caused by technology reform. On the other hand, based on China's economic and financial circumstances and the development level of financial market, we should gradually carry out financial supervision reform measures and stability criteria, improve risk management in banking industry, and firmly build the bottom line against systemic risk.



**ZHANG JIE** pointed in “*Securities Financial Support and the Nature and Function of Capital Market in China*” that the nature of capital market in China and its role in economic reform have long been theoretically misunderstood, contributing considerably to the inadequacy of the reform policies in related fields. In fact, capital market, which has been required of taking the macro-responsibility of providing securities financial supports since birth, only serves to set up a special joint system in combination with the credit financial support provided by banks. It is therefore justified to say that government, the dominant player in the reform, entered into contract

with investors and listed companies aiming at three simultaneous targets: economic growth, enterprise financing and investors' profit. Coordination of these pursuits has been a heavy burden for the government ever since. For this reason, reform measures in terms of the micro-structure of the capital market (such as the split share structure reform) are largely to end in nowhere. The determinant of the capital market development will be neither the courage or preference of policy makers nor the unilateral value judgments made by economists. Instead, it will be the innate demand of the economic reform and development for the securities financial support.

According to the article “*Reflections on the Relation Between Financial System and Real Economy*” by **ZHANG XIAOPU** and **ZHU TAIHUI**,

a precise understanding of the relationship between financial system and economic fluctuations is extremely crucial for financial development and risk prevention. They investigated into such relationship from two aspects of theoretical research and economic practice. The research found that the relationship between financial system and real economy has not been fully understood within the mainstream economic theory. This finding constructed the essential theoretical background for the eruption of the recent international financial crisis. Financial system, in its very nature, is not the fictitious economy which stands opposite to the real economy. Rather, it is one of the service industries, which contributes directly to the output of real economy, as well as the core part of resource configuration in the real economy. The precondition of improving the efficacy of financial system and preventing financial crises is to precisely understand the operating mechanisms of financial system and the matching degree between financial system and real economy.







In the article “***International Exchange Rate Arrangements and RMB Internationalization***” **ZHANG ZHIXIANG**

pointed out that over the past 40 years, the floating rate system has fully proved that the disturbance caused by this system has resulted in instability of economic development and even led to financial and economic crisis. In the context of such an

arrangement of international exchange rate, we make the following suggestions. First, China should stick to a regulated exchange rate arrangement based on the rules of IMF. Second, improve the exchange rate formation system according to China’s situation, in order to keep away from the negative effects on economic development due to exchange rate fluctuations. Third, promote RMB internationalization in a positive, steady and prudential way. RMB internationalization need to go through three stages. The first stage is from 2010 to 2020, when China should encourage the use of RMB as the trade settlement currency for countries and regions trading with China. The second stage is from 2020 to 2030, to develop RMB pricing and settlement service in financial market. The third stage is from 2030 to 2040, to promote RMB as one of the main reserve currencies and establish the RMB district in Asia.

In her speech “***Three Matters to Consider for the Globalisation of China’s Financial Industry***”, **ZHAO HAIYING** indicated that

after years of reform, China’s financial sector has changed significantly and financial institutions are more competitive. Chinese financial market is more effective and open, and has greater depth. The global financial crisis creates a special opportunity for China’s financial industry. It is just the time to discuss the globalisation of China’s financial industry, because of the following three reasons. In the process of the globalisation of China’s financial industry, three things have to be considered. First, we need to learn about western



world's experience and lessons on financial regulation and operation. Second, we need to think about how China's financial reform can use their experience and learn their lessons. Third, based on these, we need to look into the opportunities for future development of China's financial market and the challenges of globalisation.



The article “*The Situation and Challenges Enterprises Face and Their Way Out*” by **ZHAO XIJUN** aims to compare the situations that enterprises face in 2012 and 2013, so as to identify new challenges Chinese enterprises face and the choices to overcome these challenges. The industrial output in 2012 can be viewed in three aspects. First, the growth of output value and profit slowed down. Second, the growth of investment, consumption and import and export – the troika of economy – slowed down, especially for import and export. Third, Purchasing Managers Index, a more micro index of economy, shows that the market remains unchanged while the cost is rising. Based on the 2012 situation, in 2013 Chinese enterprises face both short-term and long-term challenges, and the latter is more severe, which means enterprises’ long-term effort are needed. Long-term challenges come from the following areas. First, the potential economic growth rate has slowed down since 2012. The past growth model has been challenged: enterprises’ operational cost is on the rise, and the prices of labour, land and material are also rising. Higher costs make the difficulty of Introducing technology graver. Second, in response to economic restructuring, the need for transforming corporate development model is more urgent. For the long-term development, enterprises have to consider some new costs, such as the cost of environment. The “exploding” of cost rising, which means costs are rising in every aspect, is a severe challenge. The third is regarding the enterprises’ risk management. In the past, financial sector was the centrepiece for risk management. But now the scope of risk management should be expanded and cover areas like local government’s finance.

As the reforms of interest rate and exchange rate continue,

enterprises will face fiercer challenges. Larger companies have better access to capital and stronger capability to negotiate. When loaning money to larger enterprises, commercial banks lack the pricing advantage, and therefore would choose small and medium enterprises. Commercial banks' negotiations with SMEs would raise SMEs' valuations. This may put more pressure on SMEs. Certainly, market reform can make inter-bank competition more intense, which means that enterprises can reduce their financing cost by choosing commercial banks wisely.

## Research Report

### Changes in International Trade Structure and the Internationalization of RMB

By CHEN YULU

#### Editor's Note:

*The internationalization of RMB is a key research area of IMI. Since the first issue of the “Annual Report on the Internationalization of Renminbi, 2012” and the initiate of RII, IMI has been composing and releasing the Report for consecutive years. This article is excerpt from the “Annual Report on the Internationalization of Renminbi, 2013” which sets the topic on changes of international trade structure and the internationalization of RMB. RMB-denominated settlement in cross-border trade is the foundation of the RMB Internationalization. Based on the dynamic tracking and assessment of the development of RMB internationalization, this report focuses on the analysis of the opportunities and challenges facing RMB internationalization as a result of the change in international trade structure. Through the historical research of the evolution of international trade structure and international monetary system, this report summarizes the inherent logic and general rule between the change in international trade structure and international currency replacement, which provides the theoretical basis and analytical framework for RMB’s substitution for other international currencies after China becoming the world’s largest trading nation.*

Although the recovery of the international economy was not so evident, and the geopolitics became more complicated because of the “election year”, the internationalization of the RMB still kept a fast-growing pace as the previous year. As the RMB was more accepted in international trades, international financial transactions and official exchange reserves, the Renminbi Internationalization Index (RII) climbed to a new high level. The RII in Q4/12 reached 0.87, which was a dramatic increase as compared to 0.58 at the beginning of the year.

The source of the robust growth of the RII in 2012 mainly came from two aspects. On the one hand, the percentage of RMB used as the pricing and settlement currency in global trades increased to 1.53%, which contributed 70% of the year’s RII. This was benefited from policy and regulation adjustments of the Chinese central and local governments which made it easier for corporations to choose RMB as the pricing and settlement currency. It was also benefited from the development of Hong Kong off-shore RMB market which supported trade-related RMB loans and warrants.

On the other hand, RMB financial transactions accounted for 1% of the global market, which contributed 20% of the year’s RII. The indicator Global Proportion of RMB Direct Investment increased over 1.5 times from the previous year to 2.18% in 2012. With the progressive deregulation in cross border RMB capital flows, several pilot programs with regard to RMB’s bidirectional flows were launched, which contributed to the indicator’s rapid growth.

The topic of the 2013 report is Changes in World Trade and the Internationalization of RMB. We hope to study the relationship between the internationalization of currency and the real economy through analysis of changes in world trade, currency replacement and transition of the international monetary system. We will conclude some policy implications to fertilize the long-term strategic goal of RMB internationalization.

Since the beginning of this century, great changes have taken place in the world trade structure, and some new characters have shown. First, emerging markets played more and more roles in global trade. Currently, the international trade volumes from emerging economies

in Asia, Africa, Latin America and Middle East are well matched with developed nations in Europe and North America. And exports of industrial products from developing countries to developed ones grow very fast. As the world's largest developing country, China exceeded German in 2009 and became the largest export country in the world, and kept this first place for four years thereafter. In 2013, China exceeded the United States and became world's largest importer.

Second, multilateral negotiations in the globalization of international trade are gradually replaced by regional and bilateral arrangements. The Doha trade round under the WTO framework achieved no progress and makes it tasteless. On the contrary, bilateral negotiations are in the making because of their lost negotiation costs, flexibility and high efficiency. At the same time, regional trade arrangements like the EU Single Market, North American Free Trade Zone, and the ASEAN plus Three, are more and more mature. Besides ASEAN-China Free Trade Area (ACFTA), China signed bilateral free trade agreements with Chile, Pakistan, Peru, New Zealand, Singapore, Costa Rica, Iceland, and Switzerland, and is in the process of negotiations with Australia, South Korea, Japan and the Gulf Cooperation Council.

As trades are more and more related with finance, disputes in international trades are extended to economic policies. In the past, when there was a dispute in bilateral trades, measures such as antidumping and countervailing duties and special tariffs would be taken against specific goods and services. In nowadays, besides these traditional trade disputes, major economies might also need to negotiate trade related financial issues such as exchange rate regime and export credits. With the rise of China's importance in international trade, disputes in foreign trade and economic policies faced by Chinese companies and governments rise as well. This is an important challenge, and is also a sign of China's leading role in the adjustment of the international trade structure.

Theoretically, international trade structure and international monetary architecture are inter-related. When different countries use different currencies, a pricing currency should be selected in

international trade. Usually people have three choices, i.e., currency used by the exporter, currency used by the importer, or a third-party currency. Factors including a nation's economic scale, trade structure, and volatility of the macro economy and transaction costs will impact the choice. The international use of any sovereign currency usually begins with settlements in international trades, and then investments, financial transactions and official international foreign reserves.

Normally, the change in international trade structure will result in the replacement of major pricing currencies, and then this will spread to the financial sector, and then the foreign exchange reserves. Finally it will result in the adjustment of the international monetary architecture. Trade surplus is helpful for the stability of the currency, and the position in international trades as a big player provides willingness and real demands for the currency. Historically, major international currencies were from those large trade countries.

However, according to history, not every change in international trade territory would result in a change in the international currency sector. The reasons were with the degree, scale, duration, and source of driver of the changes in international trades. Different drive models would have different impacts on the currency side. For example, almost every change in trades driven by war would result in a change in international monetary architecture. But in some other circumstances, emerging countries as large trade players did not have their currencies play more important roles, although with the development in technologies and industrialization, the export demand elasticity is quite small, and they should have more bargaining power in choosing the pricing currencies.

As emerging market countries are weak in technologies and distribution networks, they are usually "large but not strong" trade players. This makes them lose bargaining power in choosing the pricing currency. For this reason, although China is leading the new session of big change in the world's trade structure, RMB is still seldom used in the international monetary system. The combination of giant trader and short currency is contradictory but reasonable.

We proposed an important question in this report. What will be the impacts when the adjustment of the international monetary system



lags apparently behind the world's trade structure? We find that in such circumstances the issuance countries of key currencies will pay the price of current account deficits.

For example, in the 1950s, as west European countries got more competitive advantages, it was better for the less developed countries to use the aid given by the United States to buy goods from European countries. As a result, the United States faced great difficulties in its export growth, and the back-flow of the US dollar through trade was also hindered. In the Bretton Woods System, the US dollar was the only international reserve currency which was linked with gold. While other countries increased their official dollar reserves, the United States would need to pay the price of deteriorating current account deficits.

Another great change happened in the international economic and trade structure at the turn of the century. The EU zone and emerging countries such as China played more important roles while the share of the United States started to decline. However, the international monetary system kept its "1+N" structure with the position of the US dollar basically unshaken. Although China got the first position in international trades, RMB was still a weak currency in the international monetary structure. And not surprisingly, the current account deficits of the United States increased dramatically.

According to the demand and supply mechanism of the international currencies, non-residents hold a foreign currency mainly to maintain the capability to pay due debts, and the trade surplus of the issuing country will increase the confidence of the non-residents. Trade surplus is one of the prerequisites of the internationalization of a currency. And the issuing country needs to provide its currency through capital outflow. If the United States loses its position in export trades, it can only maintain large import volumes to supply US dollars to meet international payment needs. However, in that case, the flow of dollars to non-residents can not completely flow back through trade channels, and the United States had to grudgingly accept the international payments balance structure of "current account deficit - capital account surplus". Current account deficit leads to devalue of dollar and the identity of debtor country will

shake the confidence of non-residents, which are contradictory to the identity of the key international currency of dollar – namely "Triffin dilemma", the classical theory of international finance

Obviously, when the International Monetary pattern lagged the adjustment of world trade pattern, the U.S. current account balance will inevitably continue to deteriorate, making the dollar and the international monetary system face the challenge of "Triffin dilemma". Half a century ago, due to the constraint of gold, the U.S. current account deficit is not sustainable, and "Triffin dilemma" eventually leads to the disintegration of the Bretton Woods system.

However, in the Jamaican system, without the gold constraint, international capital flows and the spillover effects of the U.S. domestic economic policy seems to indicate that the large current account deficit is not unsustainable, only to increases the friction of international economic policy, particularly friction between the United States and emerging trading powers. "Dollar trap" and the 2008 global financial crisis are illustration of such international friction. "New Triffin dilemma" is actually caused by the reliance of diverse international economic on a single international currency.

Only by establishing multi-currency pattern along with the current world trade and prompting the return of international reserve assets to the original function of maintaining the ability to pay for major creditor, can we expect to break the "new Triffin dilemma". In this sense, the RMB internationalization shoulders significant historical mission. The internationalization of the RMB is bound to contribute to the reform of the international monetary system while achieving its own interests.

The new round of world trade patterns adjustment creates extremely favorable conditions for the internationalization of RMB. Especially after regional and bilateral trade become a mainstream, replacing multilateral negotiation, the influence of large regional economic power and trading power relatively increases and resistance from the major international currencies decreases significantly, which could accelerate RMB internationalization process. With the overall increase in the trade share of emerging economies, currencies issued by the largest developing countries to enter the international

monetary club will be a landmark event. Therefore, the regional or bilateral trade of China and ASEAN plus Three, SCO, BRICS, Latin America, African Union and other economies can be taken as a preferred target of RMB-denominated trade settlement. In addition, the war concerning the emerging international currency exchange rates may be started at any time, which should be fully prepared. We must also realize the internationalization of RMB will help ease a range of issues caused by the lag of international monetary pattern, including economic policies friction between nations.

The report argues that we should seize the opportunity of world trade pattern adjustment and actively promote the process of RMB internationalization. We should take full advantage of regional trade to raise the share of RMB for trade settlement in the majority of emerging economies and treat that as the focus of monetary internationalization policy at this stage. Moreover, through direct investment in RMB, the RMB capital outflow of foreign credit and other ways, we can improve the share of RMB-denominated settlement. In other words, we should spare no effort to create opportunities for domestic and international trade-related activities selecting RMB-denominated settlement.

We believe that the following issues should be specially emphasized.

First, we should correctly understand the revelation of "Triffin dilemma" to the internationalization of RMB. We should take full advantage of China's creditor status given by trade surplus, foster the willingness and actual needs of residents and non-residents to use RMB in the international scope, establish international supply and demand mechanism of the RMB, namely "capital outflow-trade inflow", use the economic entity to ensure non-residents have confidence towards RMB assets-historical experience suggests that a variety of international currencies are critical in the early stage of currency internationalization. Moreover, we should take the internationalization of the RMB as an important breakthrough to reform the international monetary system and to prompt the International Monetary to follow the world trade patterns adjustment.

Secondly, we should objectively take the fact that China is a significant trading country, but not a trade power. We should not be blindly optimistic due to the enhancement of trade share and belittle because of a temporary lack of core technology and brand. World trade patterns create a huge space for international use of the RMB and the cross-border RMB trade settlement really achieved remarkable results. We should also stay awake to the fake part of current account balance, optimize the structure of foreign trade through domestic economic transformation and upgrading and build solid foundation of trading power, striving to shift to a trade power. Historical experience shows that only when the trade status is stable and sustainable, currency status upgrade will not be short-lived.

Third, the main factor which hinders the further increase of the percentage of RMB used for pricing and settlement in over-border trade should be considered profoundly. Generally speaking, there are many factors inhibit the motivation of non-residents' use of RMB, such as companies' trade-offs on currency options and transaction cost accountings, insurmountable practical difficulties that the financial institutions faced in their development of cross-border business, and the weak infrastructure of the RMB cross-border payment and settlement system. Only by figuring out and solve the constraints successfully can the policies' pushing function on raising the percentage of RMB used for pricing and settlement in trading yields well. And only by that can we expect the RII increases with high quality and efficiency under the changing background of world trade.

In order to promote the international use of the RMB in trade, we recommend that in the short term our main purpose is to optimize the industrial structure, cultivate mature trade markets and motivate the residents and non-residents' willingness of using RMB internationally; besides, in the mid-and-long term, we should focus on establishing our status as a trading powerful nation and significantly increasing the convenience of RMB's international use.

In the short term, we should actively promote to use RMB for settlement in bilateral trade. Some methods of promoting RMB as the pricing and settlement currency, such as expanding direct investment,

improving the residents' consumption ability, and constructing free trade area or other cooperation mechanism, could be taken into consideration. Methods such as preferential policies, preferential financial services and preferential enterprise business could also be used to encourage the non-residents to use RMB in trade pricing and settlement. Besides, RMB could be considered to use as one of the bookkeeping currencies in foreign accounting and statistical work. Furthermore, we should vigorously promote the domestic financial institutions to develop non-residents' (trade related) RMB loans. In the meantime, we should encourage offshore financial market to offer RMB liquidity and foreign exchange risk hedging service for non-residents.

In the mid-and-long term, in order to keep the non-residents' demand of RMB through sustainable trade advantage, we should grasp the opportunity of the economic transformation to implement trade optimization and development. We should also strongly support the local enterprises of multinational companies which have great international influences, as that would enhance the capacity of Chinese enterprises' global resource allocation and trade negotiation power in return. Besides, we should actively construct the global RMB payment and settlement system to provide technical support for RMB's international pricing function. Internally, to meet the non-residents' needs on financial services of RMB, we should continue to deepen the reform of financial system, promote the development of international financial institutions, and promote the innovation of cross-border RMB business. Externally, we should actively promote the legislative work of the global payment and settlement and perfect the system and law construction of the offshore market. At the same time, we should properly plan the layout of the global offshore RMB market and actively study the possible impact of the offshore market development on currency internationalization, domestic financial reform, and the effectiveness of monetary policy.

Thirty years ago, only when you have "foreign exchange certificates" could you buy rare foreign goods in the Friendship Store.

Nowadays, as long as there is a popular Chinese airline's international airport duty-free store, you can shop directly in RMB.

Twenty years ago, in the early period of the socialist market economy construction, the government was busy in introducing foreign capital, the enterprises was engaged in export to earn foreign exchange, and residents would never give up the chance to change for some foreign currency assets. But now, the Chinese people have begun to invest abroad, while the foreigners are always wondering if they can buy more RMB.

A decade ago, though China has become the largest holder of foreign exchange reserves, the resultant trouble was much more than pride. Now, foreign official institutions and enterprises hold RMB in their accounts.

One day, RMB would be used in a larger scope by more people. This is not only the dream of the Chinese, but also the RMB's historical mission.

# **The Dynamics and Outlook for RMB**

## **Internationalization—Report on RMB**

### **Internationalization, Q1/2014**

By International Monetary Institute, Renmin University of China

#### **Editor's Note:**

*On 31 March, Seminar of “The Dynamics and Outlook for RMB Internationalization” and Presentation on Stage Achievements was held in Room 602 at Culture Square, co-organized by IMI, Chongyang Institute for Financial Studies and School of Finance, RUC. The “Annual Report on the Internationalization of Renminbi, 2014” sets the topic on RMB internationalization and the construction of offshore RMB markets. This seminar was the first presentation on the stage achievements of the 1<sup>st</sup> quarter 2014. Professor Tu Yonghong, vice-director of IMI, made a presentation on “The Dynamics and Outlook for RMB Internationalization” on behalf of the research team of RMB internationalization. The contents of the presentation are as the following:*

China's economy grew steadily in 2013. Financial reforms advanced in an orderly manner, policies guiding the cross-border use of the RMB experienced breakthroughs and improvements, and international trade and financial cooperation deepened. In particular, offshore markets developed very rapidly. Five main pillars have come together to push RMB internationalization into the next phase. In the third quarter of last year, the RMB internationalization index (RII) surpassed a level of 1, heralding the beginning of the RII's single-digit era. Boosted by growing market demand and the release of the “reform dividend”, the RMB saw a noticeable increase in its share of use in global markets despite greater exchange rate volatility,



hot money arbitrage, and financial turmoil in emerging markets triggered by the tapering Quantitative Easing (QE) in the US. It is estimated that the RII will climb to as high as 1.88 by the end of 2014.

## **RII Current Status and Future Outlook**

In 2013, the RMB's level of internationalization continued to increase with steady upward momentum. The RII broke through the threshold of 1 to reach 1.20 in the third quarter. It is estimated the RII rose to 1.36 by the end of 2013, a year-on-year increase of 53.61%.

Cross-border trade settlements provided a solid foundation for the internationalization of the RMB. At the end of Q3 2013, RMB cross-border trade settlement transactions performed by banks accumulated to 3.16 trillion yuan, increasing 54.15% compared with the same period last year, and accounting for 1.95% of the world total.

RMB-denominated international financial payments strengthened further. Both global credit and bond markets witnessed a further expansion of RMB use, with totals reaching 915.221 billion yuan and 66.409 billion US dollars respectively. RMB direct investment, including foreign direct investment (FDI) and outward direct investment (ODI), accumulated to a total of 137.66 billion yuan. By the end of Q3 2013, the "comprehensive global ratio" of RMB-denominated international financial payments reached 1.38%, a year-on-year rise of 66.40%.

More countries are expected to include the RMB in official reserves. The People's Bank of China (PBOC) has successively signed bilateral currency swap agreements with the central banks of Hungary, Albania, Iceland and the UK in 2013. As of the end of Q3 2013, the total amount of currency swap agreements signed between the PBOC and 23 countries and regions reached 2.22 trillion yuan. This not only facilitates RMB-denominated settlement in trade and investment deals, but also helps the RMB to accumulate its strength in international foreign exchange reserves.

In 2014 China enters a crucial phase for comprehensively

deepening reforms. Streamlining administration and delegating power as well as finance and tax system reform create a dynamic trend that is stimulating private investment. The new urbanization plan will help to stimulate consumption demand, and in advanced economies demand for imports is recovering. It is expected that China's economy will maintain stable and steady growth. Because China's trade and capital surpluses will not reverse, any violent fluctuation in the RMB exchange rate is unlikely. The willingness to use and the real demand for RMB in international economic transactions are both expected to rise. It is estimated that by the end of 2014 the RII will surge to 1.88.

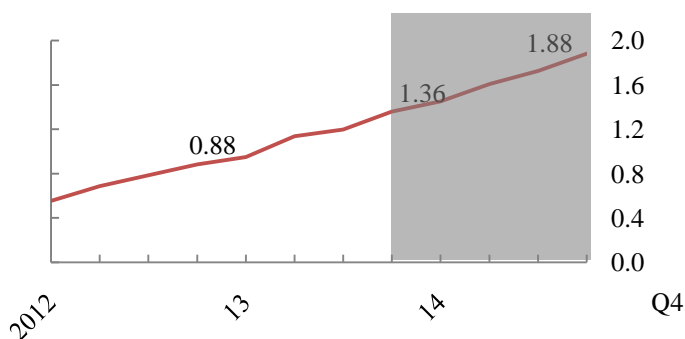


Figure1. RII

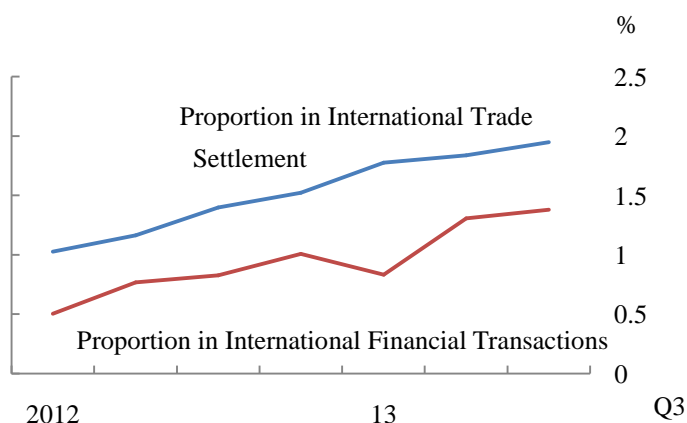


Figure 2. Use of RMB in Global Trade and Financial Transactions

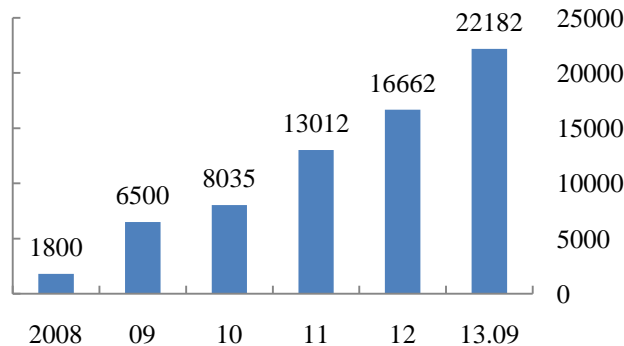


Figure 3. Size of Currency Swaps between People's Bank of China (PBOC) and Other Monetary Authorities (Unit: Hundred Million RMB)

### Growth of RII

First, Chinese economic growth is stable. Trade and investment are increasing rapidly, which consolidates the economic basis for RMB internationalization.

Second, orderly financial system reform is underway. Controls over financial institution loan interest rates are being lifted, RMB treasury bond futures are reemerging and the RMB Qualified Foreign Limited Partner (RQFLP) program was unveiled. In particular, The China (Shanghai) Pilot Free Trade Zone is the most recent benchmark for opening up that will release huge “reform dividends” and greatly boost the confidence of international markets to accept RMB.

Third, RMB cross-border use policy is improving and making breakthroughs. The review process for RMB settlement in cross-border trade and financing operations within the current account has been simplified greatly, inspiring businesses and institutions to take initiative and use RMB in foreign exchanges more regularly.

Fourth, international trade and financial cooperation are deepening. China signed a free trade agreement with Switzerland and also reached a consensus with BRICS countries to set up a plan for

contingency reserves and a broad platform for the international use of RMB.

Fifth, the offshore RMB market has developed rapidly. The scale of offshore RMB deposits in Hong Kong, Taiwan, Singapore, London, Luxembourg, Frankfurt and other places have all increased substantially. Outside of transactions in loans and deposits, CES China 120 Index Futures, RMB Euro Commercial Paper (ECP) and other financial products in RMB have begun trading in offshore markets, further enhancing the international attractiveness of the RMB.

### **Future Challenges**

The first challenge: a strong new driver of economic growth has yet to materialize. Economic transformation is still a daunting task, and constraints on resources and the environment are increasing. To a certain extent, slowing economic growth will exert a negative influence on the internationalization of the RMB in the short and medium term.

The second challenge: the exit timeframe and intensity of US Quantitative Easing (QE) is still uncertain. Emerging market countries are faced with higher risks from capital outflows and exchange rate fluctuations, and their positions in the international economy and financial system are now more complicated and difficult. External shocks may intensify RMB exchange rate fluctuations and will discourage people in the market motivated by interest arbitrage to hold RMB.

The third challenge: there is a discrepancy between the pace of interest rate liberalization and reform of the RMB exchange rate. Significant differences between onshore and offshore prices for RMB greatly stimulate exchange and interest rate arbitrage and divert the planned course of RMB internationalization away from its focus on the real economy

### **Countermeasures and Suggestions**

Relevant policies for cross-border use of the RMB have been greatly improved and various channels for capital flows have been established. In particular, investment and financing products in RMB have been gradually diversified, and the process and procedures for account settlement have been made more convenient. Individuals and enterprises can take full advantage of the low RMB interest rate in offshore markets to effectively allocate resources and reduce investment and financing costs. Furthermore, it is suggested that more attention be paid to the recent change in the RMB exchange rate to bi-directional fluctuations. Appropriate work should be done to hedge against foreign exchange risks.

Following the increased level of RMB internationalization, offshore financial markets may become an important location for transnational corporations to allocate RMB capital. It is suggested that Chinese financial institutions seize this opportunity to speed up the pace of going out into global markets, strengthen efforts to innovate the cross-border trade of RMB, bridge the gap between Chinese and foreign financial institutions and upgrade international competitiveness.

A number of reforms including liberalization of the capital account implemented by the China (Shanghai) Pilot Free Trade Zone put a higher demand on monetary policy authorities and financial regulators to provide institutional support for RMB internationalization. At present it is suggested that close attention be paid to reforming financial institutions, setting a clear path for the interest rate system as soon as possible, to establishing linkages between the interest rate and exchange rate and to allowing the market play a decisive role in the pricing of the RMB. At the same time, in-depth research into the problem of how to effectively protect national industries related to national security and core competitiveness and how to effectively prevent systemic financial crisis should be conducted during the process of opening to the outside.

## Working Paper

### Monetary Policy and Systemic Risk in China<sup>\*</sup>

By GANG JIANHUA<sup>\*</sup> and QIAN ZONGXIN<sup>\*\*</sup>

#### 1 Introduction

In recent years, China's policy reactions to the global financial crisis significantly increased the leverage. According to IMF (2013), the stock of total social financing has increased by 60 percent of GDP in four years since 2009. Much of the increased liquidity went to the housing sector, leading to a potential bubble (Wang and Sun, 2013). Moreover, economic growth slows down. China's real GDP growth rate was 10.4 percent in 2010. It declined to 9.3 percent in 2011, and then declined to 7.8 percent in 2012. As a result, concern about the systemic risk in China's financial sector increases.

In this paper, we construct an indicator of China's systemic risk, using the marginal expected shortfall (Acharya et al., 2012) of China's public listed financial institutions. Then, we use the time-varying structural vector auto-regression (TVP-SVAR) model of Primiceri (2005) to study the impact of an unexpected expansionary monetary policy on this indicator. We find strong evidence that expansionary monetary policy increased the systemic risk during the period after the onset of the global financial crisis. Moreover, the expansionary monetary policy did not successfully raise output. This result addresses the importance of a more prudential monetary policy by the People's Bank of China (PBOC).

We proceed as follows. Section 2 introduces our systemic risk indicator. Section 3 builds a model of systemic risk, inflation, output

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gap, and monetary policy and fits it to monthly data. Section 4 concludes.

## 2 Measuring the Systemic Risk in China's Financial Sector

Acharya et al. (2012) suggest that the marginal expected shortfall (MES) of a financial institution reflects the marginal contribution of a financial institution to the systemic risk of the financial sector. More specifically, the expected loss of the entire financial sector during a financial crisis is

$$ES \equiv -E(R|the\ financial\ sector\ is\ in\ crisis) \quad (1)$$

$$= -\sum_i E[y_i E(r_i|the\ financial\ sector\ is\ in\ crisis)], \quad (2)$$

where  $R$  is the return of the financial sector,  $y_i$  and  $r_i$  are respectively the market share and return of financial institution  $i$ ,  $E$  is the expectation operator. It is easy to see that,  $E(r_i|the\ financial\ sector\ is\ in\ crisis) = \frac{\partial ES}{\partial y_i}$ , the marginal contribution of institution  $i$  to the total loss of the financial sector in the crisis.<sup>1</sup>

The problem is that financial crisis is an extreme event which we do not often observe. Using the extreme value theory, Acharya et al. (2012) show that the average equity return of financial institution  $i$  during the bad days of a normal period can be a good predictor for  $E(r_i|the\ financial\ sector\ is\ in\ crisis)$ . Such an average equity return is termed “MES” by Acharya et al. (2012). More specifically, the MES of financial institution  $i$  is its average equity return when the entire stock market has its worst 5% outcomes. That is,

$$MES_{5\%}^i \equiv \frac{1}{N} \sum_{t: \text{market is in its 5\% tail}} R_t(i), \quad (3)$$

where  $MES_{5\%}^i$  is the MES of institution  $i$ ,  $N$  is the number of days that the market is in its 5% tail,  $R_t(i)$  is the stock market return of institution  $i$ .

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<sup>1</sup> We follow Acharya et al. (2012) to assume that the share of institution  $i$  in the crisis is unaffected by changes in the returns during the crisis.

We estimate the monthly MESs of China's publicly listed financial institutions with a fixed one-year window. We start the sample from October, 2008 because one of the big three banks, the China Construction Bank, is listed since September, 2007. Institutions which have missing data from October, 2008 to November 2013 are dropped from the sample.

Generally speaking, just knowing the marginal systemic risk contributions of the individual institutions is not enough for us to estimate the systemic risk because  $y_i$ , the share of each institution *during the crisis period*, is unknown. However, the systemic risk increases if the marginal systemic risk contribution of all individual institutions increase, given the distribution of  $y_i$ . This means that we can use the common trend in MESs of individual institutions to measure the systemic risk if the MESs follow similar time series trends. Table 1 suggests that this is actually the case for China in the years after the onset of the global financial crisis. The total variances of the MESs are decomposed into a "Commonality" component explained by a common factor and an idiosyncratic component called "Uniqueness". The common factor can explain more than 50 percent of the total variances in the MESs of most financial institutions in our sample.

One concern is that the fourth largest bank, the Agricultural Bank of China (ABC), is only listed since October 2010. Therefore, its MES is available only since October 2011. However, as can be seen from Figure 1, the MES of the ABC follows a very similar trend as the common factor we extracted, using the sample without the data of the ABC. Therefore, the common factor (henceforth denoted  $F_t$ ) is a good indicator of the systemic risk. Since the MESs are constructed as indicators of average equity returns during the financial crisis. A lower  $F_t$  suggests a worse outcome in the crisis. From Figure 1, we see that China's systemic risk was highest during in 2009 when the government kept the fiscal and monetary policy expansionary as a reaction to the global financial crisis. The situation becomes better in early 2010 as the monetary expansion becomes less aggressive (PBOC, 2010). End of 2011 was also a period with high systemic risk.



As we shall show, it is partly due to a surge in the global financial risk.

Figure 1: The MES of the ABC and the common factor of the MESs



The solid line is the MES of the ABC and dashed line is the common factor of the MESs.

Table 1: Variance decomposition of the MESs

Institution	Commonality	Uniqueness
Pingan Bank	0.76	0.24
Hong Yuan Securities	0.34	0.66
Shaanxi International Trust and Investment	0.62	0.38
Northeast Securities	0.57	0.43
Guoyuan Securities	0.55	0.45
Bank of Ningbo	0.80	0.20
Shanghai Pudong Development Bank	0.95	0.05
Huaxia Bank	0.76	0.24
Minsheng Bank	0.94	0.06
CITIC Securities	0.78	0.22
China Merchants Bank	0.96	0.04
Sinolink Securities	0.40	0.60
Haitong Securities	0.69	0.31
Bank of Nanjing	0.82	0.18
Industrial Bank	0.98	0.02
Bank of Beijing	0.84	0.16
Pingan	0.66	0.34
Bank of Communications	0.95	0.05
Industrial and Commercial Bank of China	0.53	0.47
China Life	0.36	0.64
China Construction Bank	0.86	0.14
Bank of China	0.86	0.14
CITIC Bank	0.88	0.12

Sample period: 2008M10-2013M11.

Source: The Wind database.

### 3 Monetary Policy and the Systemic Risk

In this section, we investigate the impact of monetary policy on the systemic risk in China. For this purpose, we construct a structural

vector auto-regression (SVAR) model of the systemic risk, inflation, output and a monetary policy variable. The first variable is our variable of interest while the last three variables are conventional in a parsimonious SVAR model for monetary policy analysis. More specifically, the systemic risk indicator in the VAR model is the change rate of  $F_t$ . We use the change rate rather than the level of  $F_t$  in the model because unit root test suggests that  $F_t$  is not stationary in our sample period (see Table 2). We denote the change rate of  $F_t$  by  $S_t$ . Inflation is measured by the monthly CPI inflation rate and we denote it by  $\pi_t$ . Because real GDP data is not available at the monthly frequency, we use constant-price industrial value added as a proxy for the aggregate output level. Using monthly growth rate and year-on-year growth rate of the industrial value added, we can obtain a constant-price index of the industrial value added. Then, the output gap is obtained using the HP filter. We denote the output gap by  $\tilde{y}_t$ . As for the monetary policy variable, we use monthly M2 growth rate rather than the policy interest rate widely used in monetary analysis of advanced economies. The reason is that interest rates were regulated in the sample period and quantitative measures, such as the monetary aggregates, were more important in China's monetary policy practice.

We denote the M2 growth rate by  $M_t$ . Except our systemic risk measure, all data are retrieved from the CEIC database. All data are seasonally adjusted by the Census X12 method. Unit root test results suggest that  $S_t$ ,  $\pi_t$ ,  $\tilde{y}_t$  and  $M_t$  are all stationary variables.<sup>2</sup>

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<sup>2</sup> Although the ADF test cannot reject the unit root hypothesis of  $\tilde{y}_t$ , the Phillips-Perron test reject the unit root hypothesis at the 5% level. Given the relatively limited power of unit root tests in small samples, we choose to model the output gap as a stationary variable. This is also a common practice in the literature.

Table 2: Unit root test results

	$F_t$	$S_t$	$\pi_t$	$\tilde{y}_t$	$M_t$
ADF test statistic	-1.31	-6.52	-4.07	-2.31	-6.71
1% critical value	-3.54	-3.54	-3.54	-3.54	-3.54
5% critical value	-2.91	-2.91	-2.91	-2.91	-2.91
10% critical value	-2.59	-2.59	-2.59	-2.59	-2.59
Philips-Perron test statistic	-1.66	-8.17	-4.07	-3.35	-6.82
1% critical value	-3.54	-3.54	-3.54	-3.54	-3.54
5% critical value	-2.91	-2.91	-2.91	-2.91	-2.91
10% critical value	-2.59	-2.59	-2.59	-2.59	-2.59

Lags in the ADF test selected by the Schwarz information criterion. All tests include a constant but no deterministic trend.

For structural analysis, the identification of economic shocks are important. We use the popular recursive identification scheme in this paper. For recursive identification, the ordering of variables is the key. We follow Primiceri (2005) to order  $\pi_t$  before  $\tilde{y}_t$  and  $\tilde{y}_t$  before  $M_t$ . Therefore, the monetary policy affects output and inflation with lags. We order our systemic risk measure  $S_t$  first. As observed by Reinhart and Rogoff (2009), accumulation of the risk which eventually leads to a financial crisis takes a long time. Particularly, financial crises usually happen after a long period of fundamental changes in real activities. Taylor (2009) also suggests that one source of the US subprime crisis was a *prolonged period* of over-expansionary monetary policy.

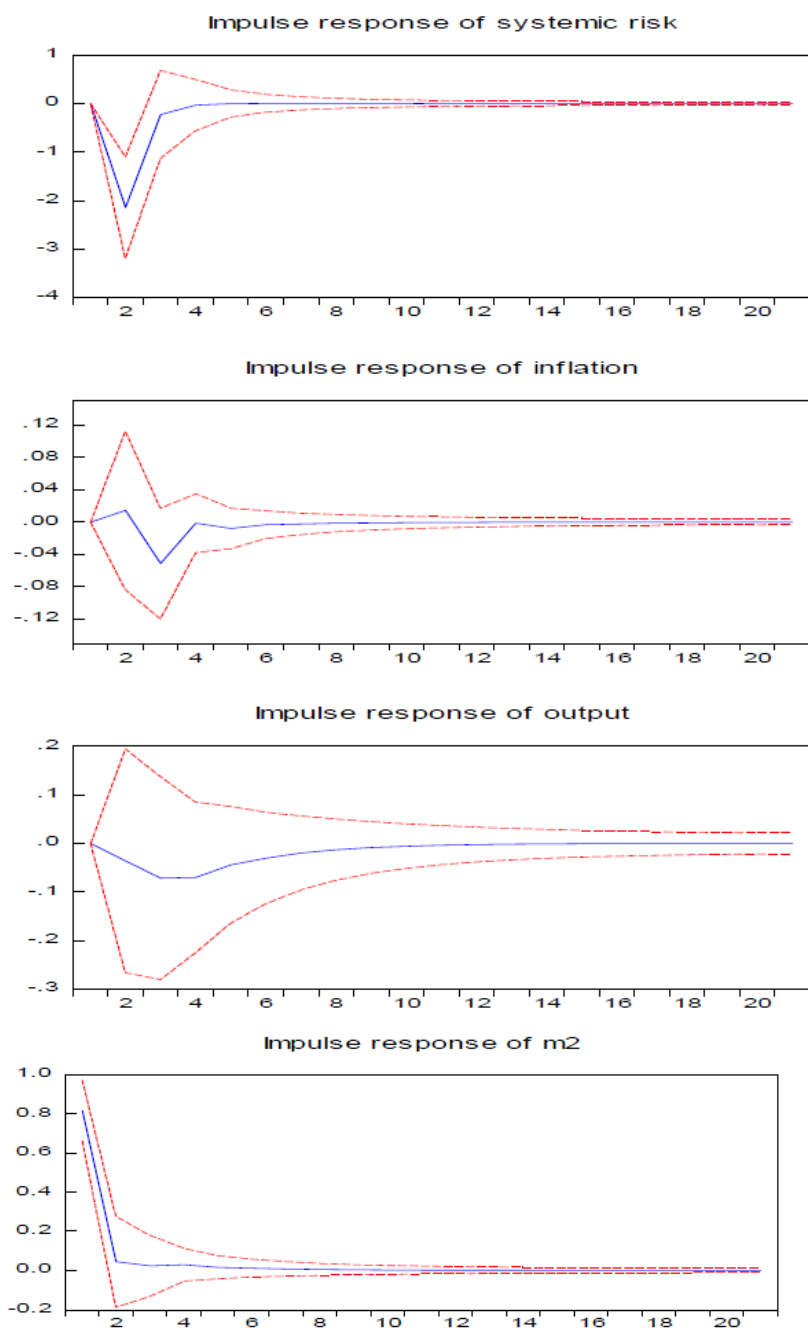
We proceed in two steps in this section. First, we show some preliminary results from the conventional SVAR model with constant coefficients and volatility. One limitation of the conventional SVAR is that the coefficient constancy assumption may not be valid due to the on-going economic reforms in China. Another limitation is that the constant volatility assumption may fail to capture changes in the shock sizes during our sample period. We use the TVP-SVAR with

stochastic volatility of Primiceri (2005) to overcome those limitations.

### **3.1 Impulse responses of the conventional SVAR model**

Figure 2 presents the impulse responses of the variables in the conventional SVAR model, in the sample period 2008M10-2013M11, to an expansionary monetary policy shock. Notably, zero lies in the 95% confidence bands of the impulse response of inflation and output gap, so unexpected monetary policy actions did not significantly affect inflation and output. By contrast, the impulse responses of the systemic risk indicator are significantly lower than zero for almost one quarter. This result suggests that an unexpected monetary expansion increases the systemic risk in China.

Figure 2: Impulse responses to an expansionary monetary policy shock



The solid line presents the mean responses and the dashed lines are the 95% confidence bands (based on 10000 Monte Carlo simulations). Numbers on the horizontal axis are months.

### 3.2 Impulse responses of the TVP-SVAR model

#### 3.2.1 The TVP-SVAR model

The TVP-SVAR model can be written in a compact way as follows

$$y_t = X_t' B_t + A_t^{-1} \Sigma_t e_t, \quad (4)$$

$$X_t' = I_4 \otimes [1, y_{t-1}', \dots, y_{t-k}'], \quad (5)$$

where  $y_t = [S_t, \pi_t, \tilde{y}_t, M_t]$ ,  $I_4$  is an identity matrix with dimension four,  $\otimes$  denotes the Kronecker product,  $e_t$  is the vector of structural shocks which have zero means and unit variances.

Denote the vector of non-zero and non-one elements of  $A_t$  by  $a_t$ . Denote the diagonal elements of  $\Sigma_t$  by  $\sigma_t$ . Time variations of  $a_t$  reflect changing effects of the  $i$ th economic shock on the  $j$ th variable. Time variations of  $\sigma_t$  reflect the changing shock sizes or stochastic volatility. Following Primiceri (2005), dynamics of the parameters are modeled as follows:

$$B_t = B_{t-1} + u_t, \quad (6)$$

$$a_t = a_{t-1} + v_t, \quad (7)$$

$$\log \sigma_t = \log \sigma_{t-1} + w_t, \quad (8)$$

Where  $u_t$ ,  $v_t$  and  $w_t$  are error terms.

The covariance matrix of the error terms is

$$V = \text{Var}([e_t \ u_t \ v_t \ w_t]') = \begin{pmatrix} I_4 & 0 & 0 & 0 \\ 0 & P & 0 & 0 \\ 0 & 0 & Q & 0 \\ 0 & 0 & 0 & T \end{pmatrix}, \quad (9)$$

where  $P$ ,  $Q$ ,  $T$  are positive definite matrices.

As the TVP-SVAR has a larger number of parameters than the conventional SVAR and our sample size is small, we estimate the model using Bayesian methods. We follow Primiceri (2005) to use uninformative priors for estimation. Details on the priors are

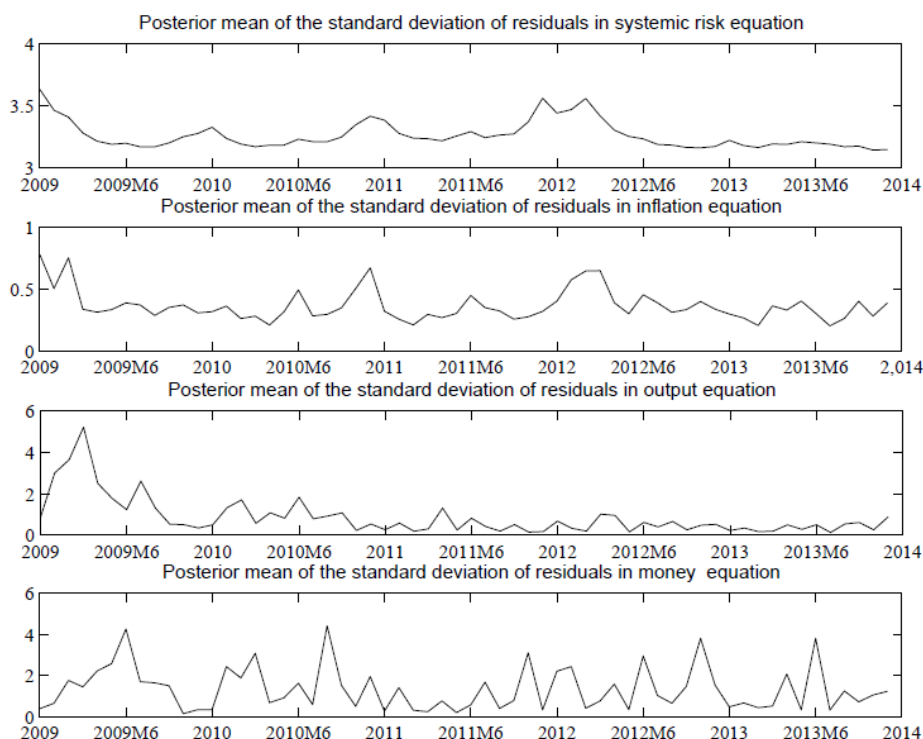
available in Primiceri (2005). The posterior distribution is simulated using Gibbs sampling.

The main results are summarized in the next two subsections.

### 3.2.2 Stochastic Volatility

Figure 3 presents the estimated posterior means of the stochastic volatility of the model variables. As can be seen, the size of the shock to China's systemic risk jumped upward at the beginning of 2009. This reflects the impact of the global financial crisis on China's financial system. Around that period, several Chinese banks reported losses from investments in the United States.<sup>3</sup> The global financial crisis also affected the size of the shock to China's inflation and output. This can be seen from the jump in the stochastic volatility of those two variables in 2009.

Figure 3: Stochastic volatility



<sup>3</sup> [http://en.wikipedia.org/wiki/List\\_of\\_write\\_downs\\_due\\_to\\_subprime\\_crisis](http://en.wikipedia.org/wiki/List_of_write_downs_due_to_subprime_crisis)



Another period of high systemic risk volatility starts from the end of 2011 and ends in early 2012. This again reflects the impact of a surge in global financial risk. To see this, we plot a measure of jump risk in the US financial market in Figure 4. The jump risk measure is constructed following Alexander and Kaeck (2008). More specifically, the jump risk is measured by the difference between 30-day VIX<sup>4</sup> and 3-month VIX. This is motivated by the fact that a decrease in short-term volatility compared with long-term volatility indicates a lower likelihood of downward jumps in equity prices over the shortterm than over the longer term. From Figure 4, we see that the global financial risk significantly increased in the end of 2011, after a relatively tranquil period. Analysts believed that this surge in the global financial risk raised sovereign credit risk in the emerging market countries including China.<sup>5</sup> Figure 4 shows that the credit default swap (CDS) spread of China's sovereign bond, usually taken as the insurance premium on China's sovereign bond, indeed increased in the end of 2011.<sup>6</sup> However, the surge in the global financial risk is not the only reason why China's sovereign credit risk increases. Growth slowdown concerns and the worry about the burst of a housing bubble also added to the sovereign risk at the time. No matter what are the reasons for the change in China's sovereign credit risk, the increase in the sovereign credit risk may have increased the uncertainty in the financial sector. Particularly, it has been documented by Demir-Kunt and Huizinga (2013) that an increase in the credit risk of the public sector could increase the risk in the financial sector.

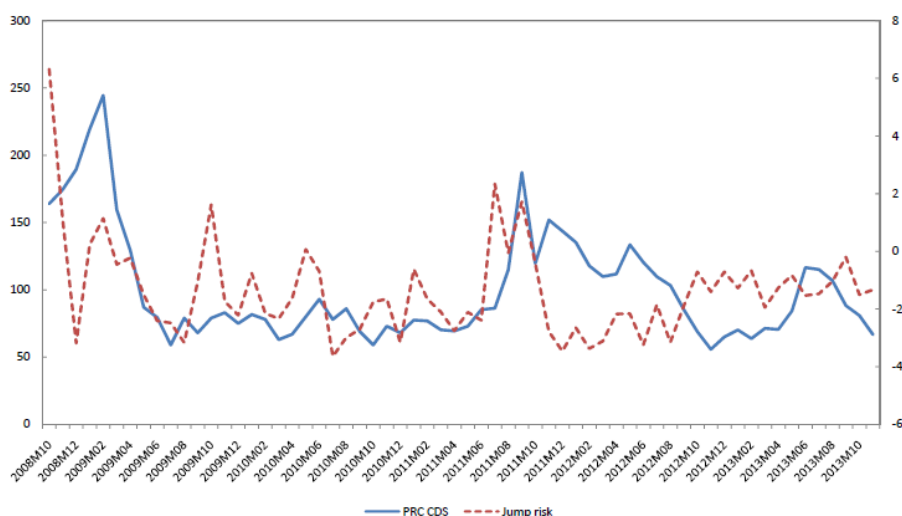
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<sup>4</sup> VIX is the symbol for the Chicago Board Options Exchange Market Volatility Index, a measure of market expectations of near-term stock market volatility conveyed by the stock index option prices.

<sup>5</sup> See, for example, <http://www.piie.com/blogs/china/?p=480>

<sup>6</sup> We report the 5-year CDS spread because it is the most liquid market segment of sovereign CDS.

Figure 4: Jump Risk in the global financial market and China's 5-year sovereign CDS spread



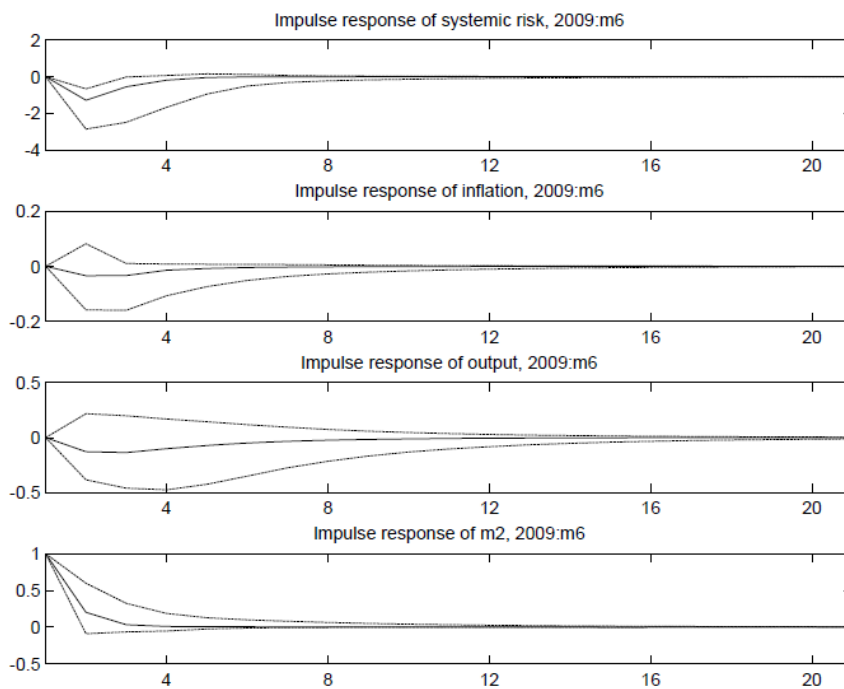
The solid line is the CDS spread, the dashed line is the jump risk. The left axis is the CDS spread (in basis points), the right axis is the jump risk.

### 3.2.3 Impulse responses

As we have discussed, one advantage of the TVP-SVAR model over the conventional SVAR model is that it allows the coefficients to vary over time, and therefore, takes into consideration the impact of economic reforms and other structural changes in the Chinese economy. As a result, we can investigate the impact of monetary policy on the systemic risk in different time periods. We consider four different periods. Two periods (2009M6, 2011M10) features high volatility of systemic risk, and therefore, are relatively turbulent periods in terms of financial stability. Another three (2010M6, 2012M6) features relatively low volatility of systemic risk, and therefore, are relatively tranquil periods in terms of financial stability. The impulse responses of the variables to an unexpected expansionary monetary policy are summarized in Figure 5 to 8. Although the impulse responses differ quantitatively, the qualitative results are very similar. An expansionary monetary policy shock significantly raises the systemic risk in all periods which we considered. The impact is largest in the second month after the shock and gradually fades away after about one quarter. There is no

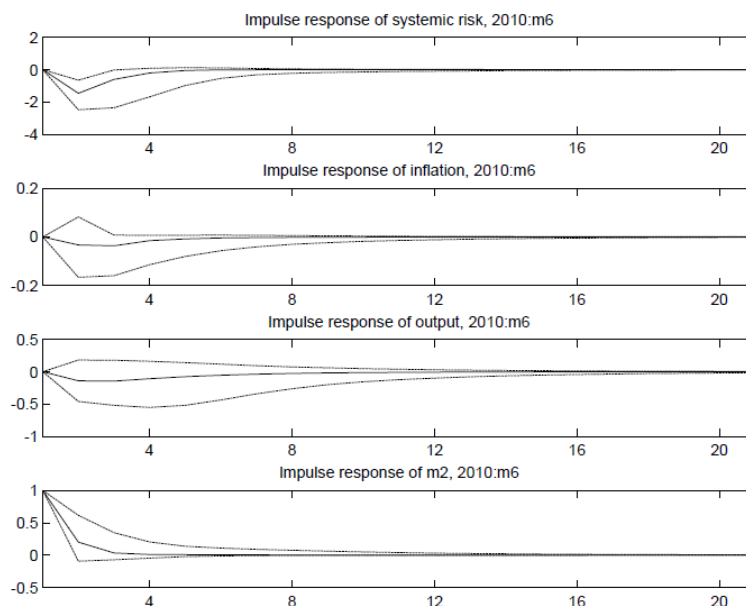
significant impact of an expansionary monetary policy on inflation and output. This suggests that China may have already been in a liquidity trap. In this case, there is not enough effective demand in the real sector, and it is not attractive for entrepreneurs to invest in new projects. More liquidity supply stimulated by a monetary policy does not necessarily encourage investment in new projects in the production economy. Instead, it can be used for speculative purpose. Speculation then increases the risk of lenders and raises the systemic risk in the financial sector.

Figure 5: Impulse responses to an expansionary monetary policy shock, 2009M6



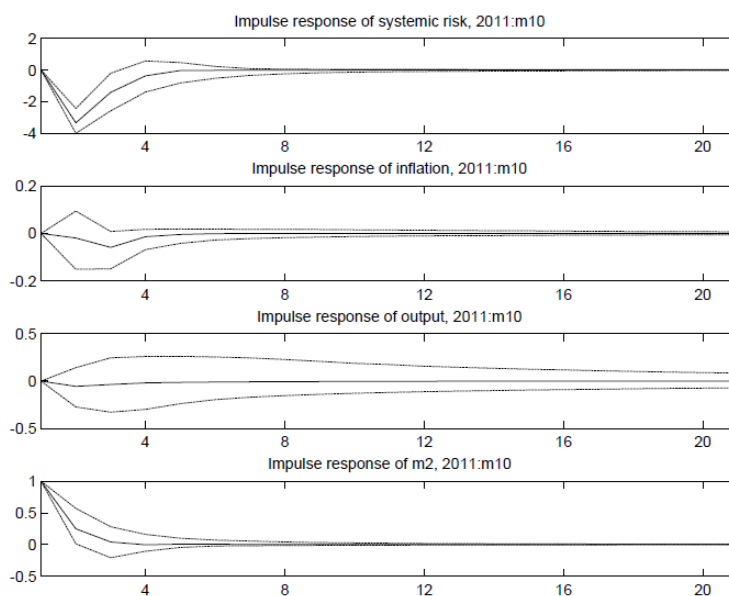
The solid line presents the posterior median responses and the dashed lines are the 0.025 and 0.975 quantiles (based on 10000 simulations, burn in 2000 draws). Numbers on the horizontal axis are months.

Figure 6: Impulse responses to an expansionary monetary policy shock, 2010:m6



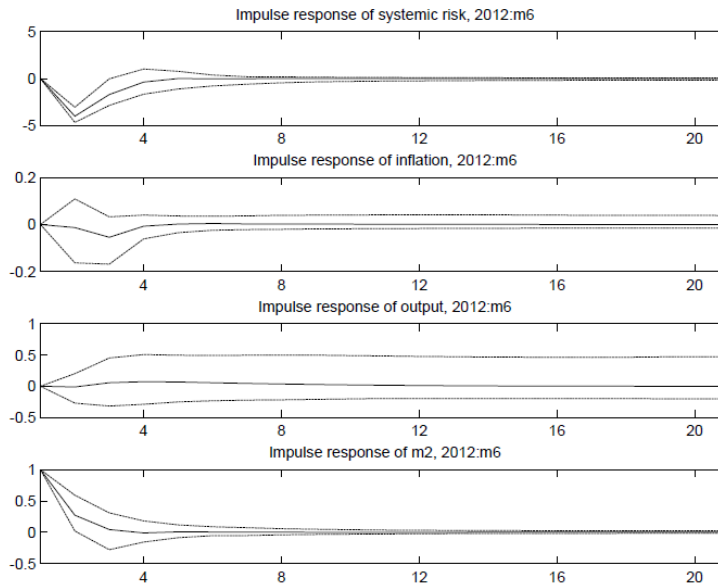
The solid line presents the posterior median responses and the dashed lines are the 0.025 and 0.975 quantiles (based on 10000 simulations, burn in 2000 draws). Numbers on the horizontal axis are months.

Figure 7: Impulse responses to an expansionary monetary policy shock, 2011:M10



The solid line presents the posterior median responses and the dashed lines are the 0.025 and 0.975 quantiles (based on 10000 simulations, burn in 2000 draws). Numbers on the horizontal axis are months.

Figure 8: Impulse responses to an expansionary monetary policy shock, 2012M6



The solid line presents the posterior median responses and the dashed lines are the 0.025 and 0.975 quantiles (based on 10000 simulations, burn in 2000 draws). Numbers on the horizontal axis are months.

#### 4. Conclusion

We construct an indicator of the systemic risk in China's financial sector. According to this indicator, China's systemic risk was very high in 2009. One reason of this surge in the systemic risk was an increase in the size of the shock to China's financial stability.

Particularly, the collapse of the Lehman Brothers triggered an increase in the jump risk of the global financial market. Another important reason, according to our analysis, is the excessively expansionary monetary policy since the end of 2008, as a response to the global financial crisis. The target of the monetary expansion was to reduce the impact of the global financial crisis on China's real economy, and to prevent a deflation and recession. However, we find that the monetary expansion did not raise inflation or output. Rather, it significantly raised the systemic risk in the financial sector. Our results call for a more prudent monetary policy to prevent the accumulation of financial risk which could ultimately lead to a financial crisis and disturb China's economic development.

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## Recent Macroeconomic Stability in China<sup>\*</sup>

By HE QING<sup>\*</sup> and CHEN HAIQIANG<sup>\*\*</sup>

*The volatility of Chinese GDP growth has been markedly lower since the mid-1990s. We utilize frequency domain and vector autoregression (VAR) methods to investigate the origin of the observed volatility reduction in the Chinese economy. Our estimation indicates that lower volatility of random shocks to the economy, or the good luck hypothesis, accounts for most of the decline in macroeconomic volatility. Although good policy and better business practices are also contributing factors, they play a marginal role in dampening China's economic fluctuations. (JEL Classification: C33; E31; E32; J00)*

### 1. Introduction

The striking reduction of output volatility in most industrial economies since the early 1980s, also known as the Great Moderation, has attracted extensive attention in recent years. Starting with the work of McConnell et al. (1999), a number of researchers investigate the sources of the sharp decline in macroeconomic volatilities. However, substantial disagreement on the origin of the Great Moderation continues. Clarida et al. (2000) and Boivin and Giannoni (2006) claim that good policies, such as improved monetary policies, have tamed the business cycle. Meanwhile, McConnell et al. (1999) and Kahn et al. (2002) suggest that improved business cycle practices, such as inventory management and financial innovations,<sup>1</sup> account

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<sup>1</sup> Dynan et al. (2006) find evidence that financial innovation is a likely contributor to the

for a significant fraction of the reduction in output volatility. Simon (2000) and Stock and Watson (2002) argue that the decline in output volatility may simply reflect milder shocks impacting the economy. More recently, Justiniano and Primiceri (2008) show that investment-specific technology shocks account for most of the sharp decline in output volatility.

This sharp decline is not a phenomenon unique to western economies. Some studies note that China has also experienced a substantial reduction in output volatility since the mid-1990s (Brandt and Zhu, 2000; He et al., 2009; Du et al., 2011). However, so far little is known about the reasons behind China's economic moderation.

This paper adds to the existing literature by analyzing the time-varying volatility of the macroeconomic fluctuations in China, which is the largest emerging market economy and plays an increasingly important role in the world economy. The case of China is interesting for two reasons. First, different from western economies, China's moderation occurred with an exchange rate peg, capital control and financial repression. That western economies and China, with such diverse economic structures and macroeconomic environments, experienced a comparable volatility reduction provides an ideal venue for examining the driving force of this increasing macroeconomic stability.<sup>2</sup> Second, output volatility reduction is usually associated with relatively lower average growth rates of output in developed countries. China has experienced a substantial reduction in output volatility since the mid-1990s, but its economy has continued to grow rapidly. Over the past three decades, the growth rate has been, on average, about 10 percent, and has been much higher than that of all western countries. Studying Chinese macroeconomic volatilities can further clarify the relationship between economic growth and volatility.

To understand the driving force of recent Chinese macroeconomic moderation, we use the two-step strategy developed by Ahmed et al.

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mid-1980s stabilization.

<sup>2</sup>Ahmed et al. (2004) report that the standard deviation of the GDP growth rate halved from the 1960-1983 period to the 1984-2002 period. Based on the Chinese data, we find that the standard deviation of the GDP growth rate is 4.02 between 1979 and 1994. After 1994, the standard deviation halves, falling to 1.96. See Table 1 for more detailed summary statistics.



(2004). In the first step, a spectrum analysis is employed to decompose the variances of macroeconomic variables by different frequency bands. The frequency domain method allows us to associate the volatility shifts with each possible moderation explanation.<sup>3</sup> We then identify a variety of VAR models to complement the frequency domain analysis in the second step.<sup>4</sup> The counterfactual analysis based on these VAR models allows us to determine whether the volatility reduction is due to changes in economic structure or changes in random shocks.

The main finding of this paper is that Chinese macroeconomic volatilities have experienced a substantial decline since the mid-1990s. In particular, we find that most reduction is due to milder shocks hitting the economy in the post-1994 period. Our results show that the post-1994 shift in spectrum is proportional across all frequencies for a wide range of macroeconomic variables, including the aggregated real GDP growth rate. Improvements in policy implementation and better business practices that may change the economy's response to shocks, rather than the exogenous shocks themselves, do not have a significant impact on volatility reduction. The estimates of the VAR analysis corroborate this finding. Although structural breaks in the coefficients across the two periods are found, supporting the importance of changes in the economic structure, the reduction in the innovation variance still plays a dominant role in driving output volatility.

Our results call into question the sustainability of the growth of the Chinese economy. Despite a remarkable economic growth performance over the last three decades, the Chinese economy still relies on a strategy of incremental reform and extensive growth,<sup>5</sup>

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<sup>3</sup>Ahmed et al. (2004) show that the spectrum shift at the business-cycle frequency reflects changes in monetary policy while relevant changes in business practices are more likely to be associated with relatively high frequencies. Finally, shifts of innovation shock generate a proportional change in the spectrum at all frequencies.

<sup>4</sup>Our estimation procedure closely follows the methodology of Ahmed et al. (2004). However, we include estimations of structural VAR models in addition to the reduced-form VAR analysis. We are indebted to one of the referees making this point.

<sup>5</sup> A growth pattern is characterized by using the expansion of inputs to promote economic growth. The popular view that China has followed an extensive growth model (for example, Wolf, 2011) has been challenged by the evidence of Zhu (2012), who shows that aggregate productivity growth has been the major driving force of China's growth since 1978. However, Zhu (2012) admits that many obstacles and distortions exist during China's

which renders it far from a market-oriented economy. As Prasad (2008) suggests, Chinese growth strategy has reduced the flexibility of the economy to withstand and recover against any large economic shock. Although the Chinese economy has maintained a high growth rate with low volatility, our results show that reduced random economic shocks, or just good luck, may account for much of the stability of the Chinese economy, while good policy and good business practices, which are more likely to provide ongoing economic stability,<sup>6</sup> have only played minor roles in the decline in macroeconomic volatilities. Unfortunately good luck can become bad luck in the future. Reforms to improve policy effectiveness and business cycle practices are crucial for China to prepare for potential future economic shocks, and to maintain sustainable economic growth.

The paper is organized as follows. Section 2 presents evidence and possible explanations of the moderation of macroeconomic volatility in China. Section 3 describes our frequency domain analysis. A variety of VAR models are employed to address the source of the reduction in fluctuations in Section 4. Conclusions and policy discussions are given in Section 5.

## **2. Macroeconomic Fluctuations and Theoretical Considerations**

### **2.1 Volatility of the Chinese macro-economy**

The most striking feature of the Chinese economy from the past three decades is its impressive growth during the reform period. Fluctuations in the Chinese macroeconomic variables reduced substantially from the mid-1990s (see Brandt and Zhu, 2000; He et al. 2009; and Du et al. 2011). To investigate how this moderation came about over the last three decades, we now review the patterns of key macroeconomic time series from the first quarter of 1979 to the fourth quarter of 2010. Our data are drawn from the CEIC database, except for the quarterly real GDP growth rate before 1994 which is

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economic reform, which may prevent productivity growth from being realized. Using firm-level data, Hsieh and Klenow (2009) show that total factor productivity gains about 30 to 50 percent if distortions in Chinese factor productivity are reduced to the U.S. level.

<sup>6</sup> For example, the improvement of inventory management techniques may cause structural changes in production areas and permanently reduce their variability.

obtained from Abeyasinghe and Rajaguru (2004). Our analysis is based on quarterly data after removing the trend and seasonal components.<sup>7</sup> Specifically, real variables are transformed into growth rates (quarterly year-on-year growth rate), and prices are transformed into inflation rates (quarterly year-on-year growth rate). Definitions and specific transformations used for each series are reported in the Appendix.

Figures 1 and 2 provide graphical evidence for the declining volatility of output and inflation (the growth rate of the consumer price index (CPI)). Figure 1 shows that the real GDP growth rate fluctuates at around 10 percent, with a range of 16 percent in 1985 to zero percent growth in 1989. The growth rate rebounded to 14 percent in 1994. Since then, however, the output growth rate has been markedly less volatile, moving within a band of 6.2 and 13.8 percent. The CPI inflation rate also shows large fluctuations before 1994, with the bottom at 1 percent in 1990Q3 and the peak at 25 percent in 1994Q4. Thereafter, the inflation rate moderates substantially within a range of -1 percent to 8 percent, most of the time. The CPI inflation rate drops dramatically with deflation emerging in early 1998 and lasting until 2002. Positive annual inflation appears in 2003 and peaks at 8 percent in 2008Q1.

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<sup>7</sup> When quarterly data is unavailable, we used the Chow-Lin method (1971) for temporal disaggregation to transform each series from annual data into quarterly data.

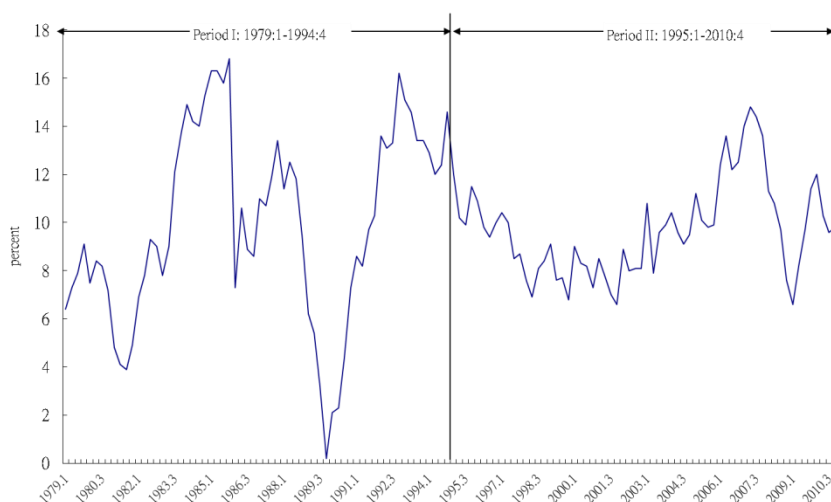


Figure 1. Real GDP (Quarterly Year-on-Year Growth Rates)

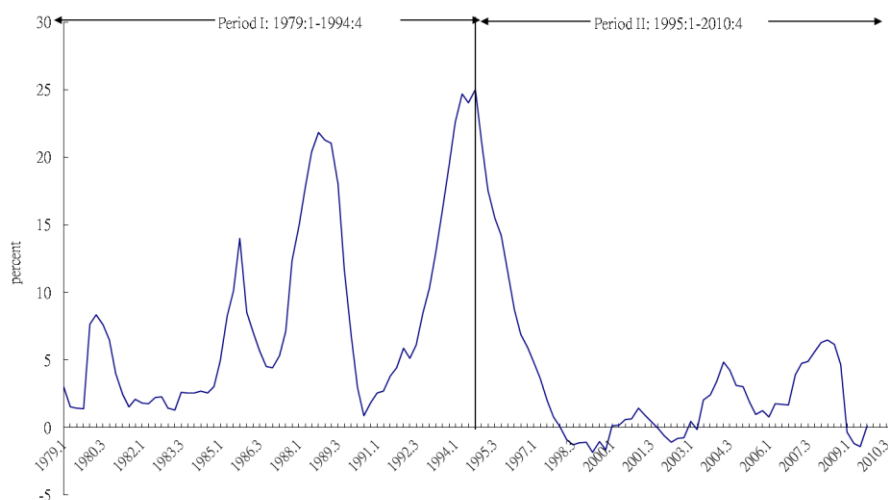


Figure 2. Consumer Price Index (Quarterly Year-on-Year Growth Rates)

Table 1 reports the basic summary statistics of some Chinese macroeconomic variables. Significant volatility reductions are found when standard deviations are compared from before and after the 1994 break date (denoted as Period I and Period II hereafter). The magnitude of the decline is striking, and is comparable with the

volatility reduction in the U.S. Although the average growth rates do not show an evident decline, all series were less volatile in the second (post-1994) period. Between 1979 and 1994, the standard deviations of the real GDP growth rate and the CPI inflation rate were 4.02 and 7.53, respectively. After 1994, they fell to 1.96 and 4.77, respectively.<sup>8</sup> On the production side, the standard deviations of Period II range from 1.94 (primary industry output) to 2.34 (secondary industry output), and are quite different to Period I where primary industry and secondary industry output were 3.97 and 7.66, respectively. On the demand side, Period II standard deviations range from 2.32 (inventory) to 10.67 (investment), much lower than those in Period I.

The reduction in volatility is reflected in other variables as well. For example, the fluctuation in the nominal effective exchange rate (NEER) shows a clear reduction in Period II. In contrast, the standard deviation of interest rate increases in Period II, implying that China gradually increased the flexibility of the interest rate to strengthen the effectiveness of monetary policy.

Table 1. Means and Standard Deviations for Quarterly Year-on-Year Growth Rates

	Mean		Difference	Standard Deviation		Difference
	Period I	Period II		Period I	Period II	
GDP	9.98	9.71	-0.27	4.02	1.96	-2.06
Inflation	8.18	2.97	-5.21	7.53	4.77	-2.76
Inventory	8.61	5.37	-3.24	2.41	2.32	-0.09
Primary Output	5.20	4.01	-1.18	3.97	1.94	-2.02
Secondary Output	11.99	11.11	-0.89	7.66	2.34	-5.32
Tertiary Output	11.46	10.59	-0.87	6.31	2.25	-4.06
Final Sales	8.88	13.37	4.49	7.71	3.51	-4.21
Investment	17.31	17.80	0.49	38.22	10.67	-27.55
Interest Rate	8.02	6.82	-1.20	1.92	2.04	0.11
NEER	-6.00	1.71	7.71	13.52	5.47	-8.05

**Note:** We consider macroeconomic time series data from the first quarter of 1979 to the last quarter of 2010. NEER denotes the nominal effective exchange rate.

<sup>8</sup> The standard deviation of U.S. GDP growth falls from 4.4 percentage points in the 1960-1983 period to 2.3 percentage points in the 1984-2002 period (Ahmed et al., 2004).

Total observations are 128. We use the last quarter of 1994 as the break point to separate the sample into two periods: Period I (1979:Q1-1994:Q4) and Period II (1995:Q1-2010:Q4). All variables are quarterly year-on-year growth rate and are seasonally adjusted.

## **2.2 Potential sources of economic moderation in China**

In the previous section, we document a widespread volatility reduction across Chinese macroeconomic variables. To investigate the driving force of this reduction, we follow the literature (Summers, 2005) and consider three possible explanations, namely, good policy, good practice and good luck.

Boivin and Giannoni (2006) suggest that better implementation of monetary policies tames economic volatility. They argue that a successful monetary policy will create a good economic environment with low and stable inflation, which in turn removes uncertainty from firms' production; it also increases the flexibility of policy makers in responding to unforeseeable events, leading to a lower volatility of output growth.

In China, economic moderation occurred soon after several important changes of the Chinese monetary system. The conduct of monetary policy changed substantially with massive reforms since 1994. The pre-1994 period can be characterized as having used administrative controls for monetary policy, in the sense that an administrative credit plan, rather than the interest rate, served as the principal instrument for the central government to control the banking system's credit allocation. Under this plan, the central government centralized credit allocation procedures and eliminated most banks' discretion in credit allocation. This involved putting quotas on the amount of lending available, severely restricting the flow of funds outside the credit plan, which lead to a severe efficiency loss in policy implementation (Brandt and Zhu, 2000). For example, when government adopts an expansionary policy and loose credit, investment and demand for funding usually go up. However, the interest rate is not market-determined in China, so it cannot rise to lower investment and increase savings. This leads to an overheating economy and a high inflation rate, or an unstable economy. Since

1994, the Chinese government has carried out market-oriented reform to increase the effectiveness of monetary policy. The swap market and official exchange rate market were unified to allow the People's Bank of China (PBC) to influence the exchange rate through market operations. To develop more market-oriented monetary tools, the PBC introduced rediscounting and open market operations in 1995 and 1996, respectively. The interbank interest rate system was established in 1996 and the credit quota system was scrapped in 1998. Since then, most interest rates have been gradually liberalized to enhance interest rates as a monetary transmission channel. In 2005, China further reformed its exchange rate arrangement and allowed the RMB to float in reference to a basket of world currencies rather than be directly pegged to the U.S. dollar.<sup>9</sup>

With more flexible and potent policy tools, we expect monetary policy to stabilize prices and promote economic growth in a more efficient manner. However, the effectiveness of these policy instruments is open to question. Mehrotra (2007) finds that the interest rate, as a monetary policy tool, has little or no effect on the Chinese economy. He et al. (2013) employ a factor-augmented VAR analysis to investigate the effectiveness of several important monetary policy tools, and find that market-based policy instruments are only moderately effective. As Prasad (2008) suggests, China's gradual reforms of its financial system have been deficient and have led to an underdeveloped financial market. In particular, although reformed several times, the RMB exchange rate still has little *de facto* flexibility. This inflexible currency regime limits the independence of China's monetary policy, and results in extensive overuse of administrative tools in its economy (Goodfriend and Prasad, 2007).

In addition, several researchers have argued that good business cycle practices, such as improved inventory management and financial innovation can reduce output volatility. Kahn et al. (2002) suggest that firms usually make production decisions before the real

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<sup>9</sup> On August 9, PBC Governor Zhou Xiaochuan revealed that the major currencies constituting the basket are the U.S. dollar, the euro, the yen, and the Korean won. These currencies are selected because of the importance of their economies to China's current account. However, the actual weights on these currencies were not announced. Frankel (2009) provided an estimation that the weight on the dollar is about 60% and that the weight on the euro had risen to 40% by mid-2007.

demand for their products is known. Better information and inventory management can increase the flexibility of production, lowering the volatility of goods production. Meanwhile, financial innovation can enhance the ability of households and firms' to access credit resources, facilitate risk sharing and therefore better smooth their expenditures over fluctuations in the business cycle.

The hypothesis of better practices appears to be an important candidate in explaining China's moderation. China has implemented gradual reforms towards a market economy since 1978. Over the last three decades, the introduction of foreign capital, advanced technologies and management skills has improved operational efficiency and contributed to China's extraordinary economic growth. Especially after Deng Xiaoping's Southern Tour in 1992, China accelerated its market-oriented economic reforms (Naughton, 1996). In the post-1994 period, waves of privatization have permeated China's industry. A large number of private firms have emerged and play an increasingly larger role in the Chinese economy. Entrepreneurs in non-state-owned firms, being profit maximizers, are more likely to employ new technology and advanced inventory management skills to optimize production procedures and make the highest returns.<sup>10</sup> As firms become more production efficient, they are better able to weather economic fluctuations, reducing production volatility. During the same period, the financial market experienced a substantial change as well. Two domestic stock exchanges (Shanghai Stock Exchange and Shenzhen Stock Exchange) were established in 1990 and grew very fast.<sup>11</sup> Almost concurrently, the real estate market went from being nonexistent to being comparable in size to the stock market. Meanwhile, non-state-owned banks and other financial institutions were allowed to expand their business within China. This technological progress and financial innovation allowed firms and consumers to better cushion themselves against any large economic shock.

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<sup>10</sup> As the state owns SOEs, and delegates its control to enterprise's managers, the separation of ownership and control gives managers less incentive to maximize profits by streamlining the production process (Lin et al., 1998).

<sup>11</sup> At the end of 2011, the total market capitalization of SHSE and SZSE ranked second in the world.



Although these transitions have been encouraged by high and relatively stable economic growth, each has brought with it some challenges. Large state-owned banks still dominate China's financial system. They tend to channel cheap credit to SOEs, and distort incentives for investment. Meanwhile, small- and medium-sized firms in the private sector find it difficult to raise funds in the formal financial market.<sup>12</sup> This hampers innovation and entrepreneurship. Securities markets are inefficient as prices are not driven by the fundamental value of corporations. Expropriations of minority shareholders are prevalent due to poor minority investor protection (Morck et al., 2000; He et al., 2010). There is a large amount of speculative investment in the real estate sector. As most funds are from state-owned banks and SOEs, investors underestimate the risks of a housing bubble, and believe that the government will provide a bailout in the event of a bubble bursting. These deficiencies limit the availability of financial instruments that enable firms and investors to manage their risks,<sup>13</sup> and limit the effectiveness of macroeconomic policies. Incentives to manage risks are also depressed.

Finally, it is also possible that the general fall in the volatility of several key variables is entirely due to good luck (Stock and Watson, 2002). That is, the moderation of economic performance is entirely due to a reduction in the number of random shocks hitting the economy. This hypothesis is also a promising explanation for China's moderation. The Chinese economy was highly volatile from the 1980s through the early 1990s, during which it was subject to several unusually large shocks, such as the failure of the "price system breakthrough" in 1988 and the Tiananmen Square events of 1989. From the mid-1990s until recently, China had neither experienced any similar crises nor a sharp recession. In the sense that the shocks hitting the Chinese economy have been smaller than before, the Chinese economy has simply experienced good luck.

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<sup>12</sup> Allen et al. (2005) argue that the private sector relies primarily on informal financing channels, such as internal funds, trade credits and financial resources from family and friends.

<sup>13</sup> Du et al. (2011) find that the extent of risk sharing through financial intermediaries and capital markets in China is very limited.

### 3. Frequency Domain Analysis

#### 3.1 Methodology

We employ frequency domain analysis to decompose a number of key economic variables of the Chinese economy into spectra, which enables investigation of the variability of different frequency components. This decomposition is possible because any covariance-stationary process  $\{x_t\}_{t=-\infty}^{\infty}$  has both a time-domain representation and a frequency-domain representation; any feature of the data can be equivalently described by the two representations.

For any frequency  $\omega$ , the population spectrum  $g(\omega)$  for  $\{x_t\}_{t=-\infty}^{\infty}$  can be defined by

$$g(\omega) = \frac{1}{2\pi} \sum_{j=-\infty}^{\infty} \gamma_j \cos(j\omega) \quad (1)$$

with  $\gamma_j$  as the population autocovariance function. The variance of  $x_t$  could be decomposed as

$$\text{var}(x_t) = 2 \int_0^{\pi} g(\omega) d\omega \quad (2)$$

where spectrum  $g(\omega)$  is interpreted as the contribution to the total variance at period  $\frac{2\pi}{\omega}$ . Accordingly, for any given frequency range  $0 \leq a < |\omega| < b \leq \pi$ , the variance attributed to these frequencies is captured by the integrated spectrum  $G(a, b)$ , given by

$$G(a, b) = 2 \int_a^b g(\omega) d\omega. \quad (3)$$

We define the normalized spectrum as  $\frac{g(\omega)}{\sigma^2}$  and its integrated

version as

$$\tilde{G}(a, b) = 2 \int_a^b \frac{g(\omega)}{\sigma^2} d\omega$$

where  $\sigma^2$  is the total variance across all frequencies as defined in Equation (2). The normalized spectrum gives the fraction of variance attributable to a certain frequency,  $\omega$ .<sup>14</sup>

The whole spectrum can be separated into three frequency bands, namely low, business cycle and high (Ahmed et al., 2004). The business cycle is assumed to last between 6 quarters and 32 quarters, corresponding to a frequency range between  $\pi/16$  and  $\pi/3$ . The cycles longer than 32 quarters (with frequency  $\omega$  smaller than  $\pi/16$ ) will fall into the low-frequency range, and cycles shorter than 6 quarters (with frequency  $\omega$  larger than  $\pi/3$ ) are classified as of the high-frequency range.

By decomposing the spectrum into three frequency bands, we can evaluate the sources of moderation by inspecting the volatility decline in different bands. First, as improved policy acts to dampen the business cycle, the spectrum in the business cycle frequency should decline disproportionately in the second sample period. Second, better business practices should enhance production productivity, inventory management and investment efficiency. These improvements are more likely to smooth output on a quarter-by-quarter basis. For instance, a better inventory system can match output to final sales more efficiently leading to a reduction of economic fluctuations, primarily in the high-frequency band. Finally, the good luck hypothesis expects that there is no change in the structure of the economy so the plunge in volatilities is attributable to a reduced variance of exogenous shock. This should produce a proportional decline in the spectrum at all frequencies. By inspecting the reduction in different frequency bands, the source of moderation in the Chinese economy in the post-1994 period can be identified.

The spectrum analysis approach is illustrated in Figures 3 and 4. In Figure 3, the upper panel depicts the spectrum of real GDP growth rate, while the lower panel illustrates the normalized spectrum. The

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<sup>14</sup> See the Appendix to Ahmed et al. (2004) for more detailed econometric methodology.

upper graph shows the spectrums in the two periods. It shows that both spectra display the typical shape of an economic variable, peaking at low frequency and gradually declining as it moves toward the business cycle frequency. These skewed shapes indicate that longer-term fluctuations (i.e., fluctuations in the lower frequency bands) contribute most to the variance of real GDP growth rate. In addition, the upper graph shows an evident downward shift of spectrum in the post-1994 period, implying a decline in the volatility of GDP growth rate. The drop in output volatility primarily occurs at the business cycle frequency level. However, the normalized spectrum shows the two sample periods with similar patterns across all frequencies. The post-1994 spectrum is only slightly lower in the low frequency, is approximately equal in the business cycle frequency and is slightly higher in the high frequency. The similarity suggests that the moderation might be largely due to a shrinkage of the innovation variance.

The spectrum patterns of inflation in Figure 4 also lend support to the good luck hypothesis. The upper panel shows a substantial downward shift of the spectrum of the inflation rate, with the greatest reduction concentrated in the low and business cycle frequencies. However, when the spectrum is normalized, the lower panel of Figure 4 shows that the post-1994 spectrum has a similar pattern to that of the pre-1994 period. The post-1994 spectrum is only slightly lower in the business cycle frequency. Hence, evidence of inflation also suggests that smaller innovation shocks may account for much of the reduction in volatility of the second period.

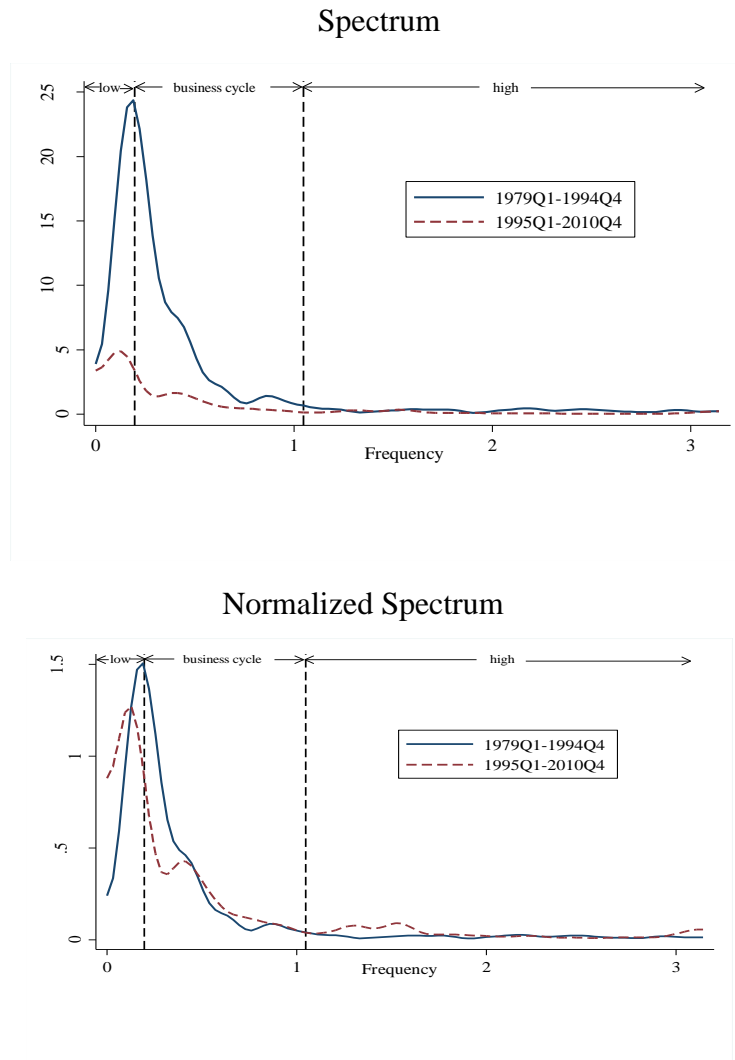
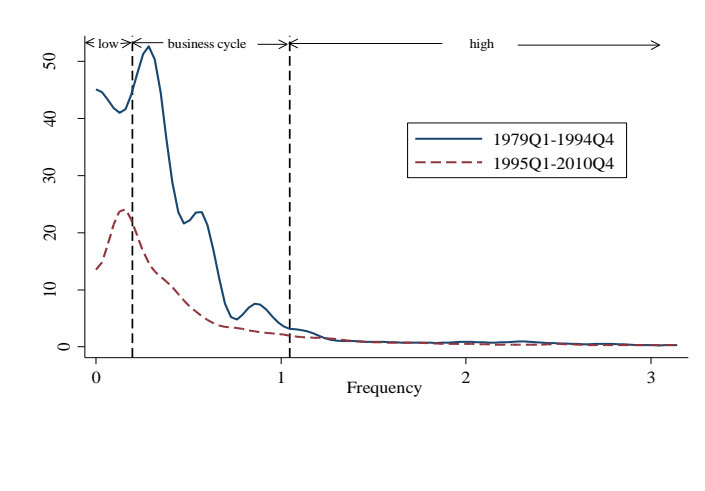


Figure 3. Real GDP

**Note:** Following Ahmed et al. 2004, the whole spectrum is separated into three frequency bands, namely low, business cycle and high. The business cycle is assumed to last between 6 quarters and 32 quarters, corresponding to a frequency range between  $\pi/16$  and  $\pi/3$ . Cycles longer than 32 quarters (frequency  $\omega$  smaller than  $\pi/16$ ) will fall into the low-frequency range, and cycles shorter than 6 quarters (frequency  $\omega$  larger than  $\pi/3$ ) are classified as in the high-frequency range.

### Spectrum



### Normalized Spectrum

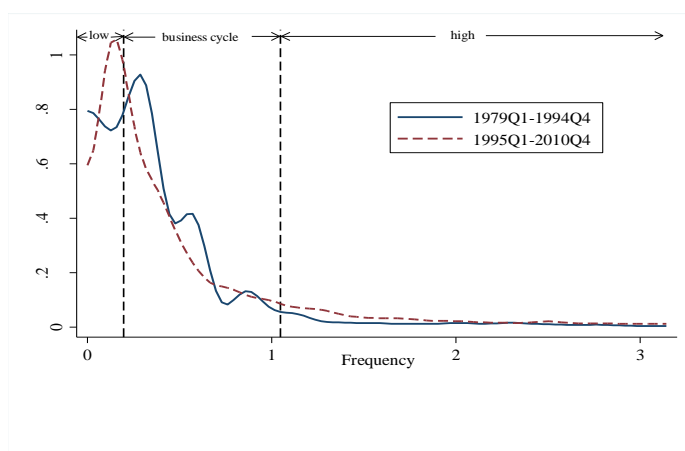


Figure 4. Consumer Price Index

**Note:** Following Ahmed et al. 2004, the whole spectrum is separated into three frequency bands, namely low, business cycle and high. The business cycle is assumed to last between 6 quarters and 32 quarters, corresponding to a frequency range between  $\pi/16$  and  $\pi/3$ . Cycles longer than 32 quarters (frequency  $\omega$  smaller than  $\pi/16$ ) will fall into the low-frequency range, and cycles shorter than 6 quarters (frequency  $\omega$  larger than  $\pi/3$ ) are classified as in the high-frequency range.

### 3.2 Estimation results

We report the results for the real GDP growth rate, inflation and the selected components of GDP. In each case, we assume that a structural break exists at the end of 1994, such that volatilities are moderated from 1995.<sup>15</sup>

The test results are reported in Table 2 and Table 3. In each of the three frequency ranges, we report the integrated spectrum estimates (integrated normalized spectrum estimates) for Period I and Period II in the third and fourth column of Table 2 (Table 3), respectively. The last two columns give the test statistics of the null hypothesis that the spectrums of the two periods are equal, and the corresponding marginal significance level (*p*-value) for the test of the null hypothesis.

Table 2 reports the estimation results of the integrated spectrum of GDP growth rate. Though the integrated spectrum shrinks substantially from Period I to Period II, the reduction is significant only for the business cycle's frequency interval, based on the *p*-values reported in the final column. Consistent with the evidence of the upper panel of Figure 3, this result shows that the variance reduction is concentrated in the business cycle frequency. The inflation rate also shows an evident reduction in volatility in the business cycle frequency.

Following Ahmed et al. (2004), we select several components of GDP growth that are relevant to business cycle policy and the good practices hypothesis, and report the estimates in Table 2. For example, business cycle policies are more likely to influence the volatility of primary sector production, final sales and investment. Secondary sector production and inventory growth are more sensitive to improved inventory practices. Table 2 shows that final sales and investment significantly decline in the business cycle and high frequencies, that the decline in the variance of primary sector production is concentrated in the business cycle and low frequencies, and that the variance of inventory falls substantially in the business cycle frequency.

To investigate the driving force of the spectrum shifts, we present

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<sup>15</sup> Our major results remain unchanged using both 1993 and 1994 as the break point.

the estimates of the integrated normalized spectrum in Table 3. For the real GDP growth rate, the reduction of output volatility appears to be even across the three different frequency ranges. The inflation rate also shows a similar result. Consistent with the good luck hypothesis, our result implies that the decline in shocks hitting the economy accounts for much of the output volatility reduction.

Turning to the selected components of GDP growth, we see that final sales and investment have no significant shifts in the normalized spectrum. Hence business cycle volatilities in these variables are not significantly lower than at other frequencies. Looking at the production components, the decline in the growth of primary sector output appears to be concentrated in the business cycle frequency, implying that business cycle practice plays an important role in smoothing the growth of primary sector production. We interpret this effect as a reflection of government commitment to promote growth in the agricultural sector. There is no evidence of shifts in the normalized spectrum of secondary sector output and inventory implying that improved inventory practice has no significant effect on smoothing output volatility. These results reinforce the good luck hypothesis.

Table 2. Estimates of Integrated Spectrum

Variable	Frequency Interval	Integrated Spectrum			
		Period I	Period II	Test	<i>p</i> -value
GDP	Low	7.09	2.00	0.92	0.18
	Business Cycle	7.86	1.30	1.75	0.04
	High	0.99	0.49	0.31	0.38
Inflation	Low	16.35	8.96	0.75	0.23
	Business Cycle	36.76	11.10	2.27	0.01
	High	2.73	2.34	0.07	0.47
Primary Output	Low	3.44	0.80	1.51	0.07
	Business Cycle	10.65	0.97	3.88	0.00
	High	1.40	1.94	-0.36	0.64
Secondary Output	Low	12.58	2.17	1.32	0.09



	Business Cycle	31.62	2.48	3.50	0.00
	High	13.63	0.74	2.84	0.00
	Low	12.90	1.72	1.50	0.07
Tertiary Output	Business Cycle	12.55	2.10	3.39	0.00
	High	13.75	1.17	3.64	0.00
	Low	10.75	4.63	1.06	0.15
Final Sales	Business Cycle	33.85	5.22	3.34	0.00
	High	13.96	2.25	2.22	0.01
	Low	163.77	10.98	1.27	0.10
Investment	Business Cycle	428.59	28.54	1.95	0.03
	High	845.93	72.64	2.14	0.02
	Low	2.85	4.03	-0.42	0.66
Inventory	Business Cycle	2.84	1.21	1.42	0.08
	High	0.00	0.04	-0.04	0.52

**Note:** We consider macroeconomic time series data from the first quarter of 1979 to the last quarter of 2010. NEER denotes the nominal effective exchange rate. Total observations are 128. We use the last quarter of 1994 as the break point to separate the sample into two periods: Period I (1979:Q1-1994:Q4) and Period II (1995:Q1-2010:Q4). All variables are quarterly year-on-year growth rate and are seasonally adjusted. Low frequency range =  $(0, \pi/16)$ ; Business cycle frequency range =  $(\pi/16, \pi/3)$ ; High frequency range =  $(\pi/3, \pi)$ . *P*-value is the marginal significance level of the test.

Table 3. Estimates of Integrated Normalized Spectrum

Variable	Frequency Interval	Integrated Normalized Spectrum			
		Period I	Period II	Test	<i>p</i> -value
	Low	0.44	0.53	-0.31	0.62
GDP	Business Cycle	0.49	0.34	0.62	0.27
	High	0.06	0.13	-0.50	0.69
	Low	0.29	0.40	-0.53	0.70
Inflation	Business Cycle	0.66	0.50	0.81	0.21
	High	0.05	0.10	-0.42	0.66
Primary Output	Low	0.22	0.22	0.04	0.48

	Business Cycle	0.69	0.26	2.94	0.00
	High	0.09	0.52	-3.22	1.00
Secondary Output	Low	0.22	0.40	-0.95	0.83
	Business Cycle	0.55	0.46	0.46	0.32
	High	0.24	0.14	0.76	0.22
	Low	0.33	0.34	-0.08	0.53
Tertiary Output	Business Cycle	0.32	0.42	-0.68	0.75
	High	0.35	0.23	0.86	0.19
	Low	0.18	0.38	-1.11	0.87
Final Sales	Business Cycle	0.58	0.43	0.86	0.19
	High	0.24	0.19	0.40	0.34
	Low	0.11	0.10	0.19	0.42
Investment	Business Cycle	0.30	0.25	0.44	0.33
	High	0.59	0.65	-0.53	0.70
	Low	0.50	0.76	-1.09	0.86
Inventory	Business Cycle	0.50	0.23	1.18	0.12
	High	0.00	0.01	-0.05	0.52
	Low	0.50	0.76	-1.09	0.86

**Note:** We consider macroeconomic time series data from the first quarter of 1979 to the last quarter of 2010. NEER denotes the nominal effective exchange rate. Total observations are 128. We use the last quarter of 1994 as the break point to separate the sample into two periods: Period I (1979:Q1-1994:Q4) and Period II (1995:Q1-2010:Q4). All variables are quarterly year-on-year growth rate and are seasonally adjusted. Low frequency range =  $(0, \pi/16)$ ; Business cycle frequency range =  $(\pi/16, \pi/3)$ ; High frequency range =  $(\pi/3, \pi)$ . *P*-value is the marginal significance level of the test.

In summary, our results show that the volatilities of the real GDP growth rate and the inflation rate have declined since the mid-1990s. Although policy effectiveness has improved through market-oriented reforms over the last three decades, the spectra do not show a significant reduction in the business cycle frequency band. Meanwhile, no strong evidence is obtained in support of better business practice being the source of the economic moderation in China, aside from in primary sector production. The good luck hypothesis, which suggests a reduction in the variance of the exogenous shocks hitting the economy, provides the more plausible

explanation for the declining macroeconomic volatility.

#### **4. Vector Autoregression Analysis**

The results of our frequency domain analysis suggest that milder shocks contribute most to volatility reduction, however it cannot rule out the possibility of structural change which may manifest as a part of the spectra reduction. To complement the frequency domain analysis, we identify a variety of VAR models, and implement a series of counterfactual analyses on the origin of the volatility reduction. As Sims (1992) suggests, a VAR analysis can allow us to understand the changes of transmission mechanisms in business cycle practices and monetary policy, and their impacts on reducing volatilities. We can investigate how important the reduction in random shocks is.

##### **4.1 Reduced-form VAR**

Our basic VAR model is similar to the small-scale model of Mehrotra (2007) in that it includes real GDP growth rate, inflation rate, the percentage change of NEER, and the interest rate. Real GDP growth rate and the CPI inflation rate are representative variables for tracking general economic performance. The NEER, or the trade weighted exchange rate, is used to capture more comprehensively the effectiveness of exchange rate policy. The monetary policy instrument, interest rate, is the lending rate determined by the central bank.<sup>16</sup>

To check the robustness of our results, we extend the basic model into a five-variable function by distinguishing between final sales and inventory. As Ahmed et al. (2004) suggest, the five-variable model examines the role of business cycle policies and inventory practices directly. For example, improved inventory management leads to lower inventory volatility, which may also contribute to a reduction in the variance of the real GDP growth rate. The lag structure of the

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<sup>16</sup> Monetary aggregate could also be used as a measure of monetary policy instrument, as quantitative methods are still the key instruments for China's government (Goodfriend and Prasad, 2007). Hence, we use the growth rate of M2 money supply as an alternative measure of monetary policy instrument. Our primary results are essentially same. These results are not reported, but are available upon request.

VAR system has been selected according to the AIC criteria. The optimal lag length is two for both four-variable and five-variable VAR models. Meanwhile, we only include a constant intercept term without a time trend.

To investigate the stability of the parameters in the VAR models above, we conduct both the Chow test of coefficient stability and the Goldfeld-Quandt test of standard errors (Goldfeld and Quandt, 1965). Under the alternative hypotheses of these tests, the VAR parameters experience a discrete shift across the two periods.

The test results for coefficient stability are reported in Table 4. In the four-variable model, the  $p$ -value applied to the GDP and inflation equations, for the null hypothesis of no change, are 0.077 and 0.060, rejecting the null hypothesis at the significance level of 10%. Only the interest rate equation appears to display coefficient stability. The structural change is further emphasized in the five-variable model as null hypotheses are rejected at the significance level of 5%, implying that all equations have coefficient instability across the two periods.

The standard deviations of the error terms and the volatility breaks test are reported in Table 5. There is clear evidence that all these equations display much less volatility in the Period II. The VAR analyses show that there are both substantial changes in economic structure and in volatility reduction, and so we cannot separate the individual effects of the three hypotheses to explain the aggregate volatility reduction.

Table 4. Stability Tests of Reduced-form VAR Coefficients

Variable	$F$ -statistic	$p$ -value
Four-Variable Quarterly Model		
GDP	1.790	0.077
Inflation	1.892	0.060
Interest Rate	0.966	0.471
NEER	6.447	0.000
Five-Variable Quarterly Model		
Final Sales	2.234	0.017
Inflation	2.241	0.017
Inventory	3.219	0.001

Interest Rate	2.060	0.029
NEER	4.595	0.000

**Note:** We consider macroeconomic time series data from the first quarter of 1979 to the last quarter of 2010. NEER denotes the nominal effective exchange rate. Total observations are 128. We use the last quarter of 1994 as the break point to separate the sample into two periods: Period I (1979:Q1-1994:Q4) and Period II (1995:Q1-2010:Q4). All variables are quarterly year-on-year growth rate and are seasonally adjusted. The  $F$ -statistic is the Chow test statistic for the stability of the coefficients.

Table 5. Innovations From Reduced-form VAR

Variable	Standard Deviation			Test	
	Period I	Period II	% change	$F$ -stat.	$p$ -value
Four-Variable Quarterly Model					
GDP	1.66	1.15	-30.56	2.07	0.00
Inflation	2.27	0.82	-63.80	7.63	0.00
Interest Rate	0.49	0.38	-20.87	1.60	0.03
NEER	6.49	2.61	-59.75	6.17	0.00
Five-Variable Quarterly Model					
Final Sales	5.07	2.26	-55.49	5.05	0.00
Inflation	2.22	0.89	-60.08	6.28	0.00
Inventory	0.23	0.14	-37.60	2.57	0.00
Interest Rate	0.48	0.36	-24.52	1.76	0.01
NEER	6.62	2.78	-58.00	5.67	0.00

**Note:** We consider macroeconomic time series data from the first quarter of 1979 to the last quarter of 2010. NEER denotes the nominal effective exchange rate. Except for the interest rate, all other variables are quarterly year-on-year growth rate and are seasonally adjusted. Total observations are 128. We use the last quarter of 1994 as the break point to separate the sample into two periods: Period I (1979:Q1-1994:Q4) and Period II (1995:Q1-2010:Q4).  $F$ -stat. is the  $F$ -statistic testing for the equality of innovation variances in these two periods.

To quantify the relative contribution of each hypothesis, we follow the method of Stock and Watson (2002) and Ahmed et al. (2004), and use VAR models to estimate the unconditional variances of each variable. The first and second rows of Table 6 present the shocks of

each period and the corresponding coefficients used to compute the unconditional variance. The counterfactual exercises are reported in the third and fourth rows, and estimate the unconditional variance by taking other period shocks into the models for each period. When Period II shocks are substituted into the Period I model, we observe a substantial reduction in output volatility as the standard deviation falls from 4.12 to 2.42. Similarly, when the Period II model is subject to Period I shocks, output volatility increases from 1.87 to 2.92. As a result, the milder shocks account for most of the reduction of output volatility from Period I to Period II (from 47 percent to 76 percent). The results for inflation are similar to those of output. As shown in Table 6, roughly 48 percent to 60 percent of the reduction in inflation volatility is due to a reduction in the number of random shocks. The results from the five-variable model, presented in the bottom panel of Table 6, reinforce these conclusions. The contribution of shocks to the volatility reduction in final sales is roughly 70 percent lending strong support to the good luck hypothesis.

Table 6. Unconditional Standard Deviation Using VAR

Coefficients	Shocks	Four-Variable Quarterly Model			
		GDP	CPI	Interest Rate	NEER
Period I	Period I	4.12	8.10	1.79	14.43
Period II	Period II	1.87	2.55	1.17	5.04
Period I	Period II	2.42	4.80	1.44	10.19
Period II	Period I	2.92	5.22	1.89	11.39

Coefficients	Shocks	Five-Variable Quarterly Model				
		Final Sales	CPI	Inventory	Interest Rate	NEER
Period I	Period I	8.58	10.72	2.91	2.60	18.24
Period II	Period II	3.48	2.66	1.82	1.07	4.92
Period I	Period II	3.90	5.08	1.77	1.44	9.11
Period II	Period I	7.05	5.44	3.22	1.94	11.86

**Note:** We consider macroeconomic time series data from the first quarter of 1979 to the last quarter of 2010. NEER denotes the nominal effective exchange rate. Except for the interest rate, all other variables are quarterly year-on-year growth rate and are seasonally adjusted. Total observations are 128. We use the last quarter of 1994 as the break point to separate the sample into two periods: Period I

(1979:Q1-1994:Q4) and Period II (1995:Q1-2010:Q4).

#### 4.2 Structural VAR analysis

To examine what the fundamental disturbances are behind the decrease in reduced-form innovation variances, we impose an economic structure on the VAR impulse response function.

Following Breitung et al. (2004), we consider the following structural VAR model,

$$Ay_t = A_1^* y_{t-1} + \dots + A_p^* y_{t-p} + C^* D_t + v_t$$

where  $y_t$  is a  $(K \times 1)$  vector of endogenous variables,  $K$  is the number of variables and  $p$  is the order of the VAR model. The term  $v_t$  is a  $(K \times 1)$  vector of structural shocks that is a zero mean white noise process with time-invariant covariance matrix  $\Sigma_v$ . The invertible matrix  $A$  is a  $(K \times K)$  non-diagonal matrix allowing the variables to have instantaneous relationships. The matrix  $A_i^*$  ( $i = 1, 2, \dots, p$ ) is the  $(K \times K)$  coefficient matrix, and  $B$  is the structural parameter matrix. The term  $D_t$  is the deterministic vector and  $C^*$  is the corresponding coefficient vector. In the present study, the deterministic terms only include constant terms which could be removed by pre-adjusting variables in practice. Therefore, for notational convenience the deterministic term is dropped from the model. We also assume a vector of structural innovations, denoted by  $\varepsilon_t$ , to be related to the model residuals  $v_t$  by a linear equation  $v_t = B\varepsilon_t$ , where  $B$  is a  $(K \times K)$  matrix and  $\varepsilon_t$  is mutually independent and follows  $N(0, I_k)$ .

Ignoring the deterministic terms and replacing  $v_t$  by  $B\varepsilon_t$ , the structural VAR model can be written as

$$Ay_t = A_1^* y_{t-1} + \dots + A_p^* y_{t-p} + B\varepsilon_t. \quad (5)$$

The reduced form VAR, corresponding to the structural form Equation (5), can be obtained by premultiplying with  $A^{-1}$ , such that

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + \mu_t$$

where

$$A_i = A^{-1} A_i^*, (i = 1, 2, \dots, p), \quad (6)$$

$$\mu_t = A^{-1} B\varepsilon_t. \quad (7)$$

We estimate the above structural model, the so-called *AB-model* in Amisano and Giannini (1997), with a set of parameter restrictions using a scoring method.

Our analysis is based on the four-variable model of Section 4.1. Following Mehrotra (2007), we impose economic restrictions to identify the structural VAR impulse response functions. The model is comprised of four endogenous variables, namely, the growth rate of real output denoted as  $y$ , the percentage change of CPI denoted as

$p$ , interest rate denoted as  $i$  and the percentage change of the exchange rate denoted as *neer*. The errors of the reduced-form VAR, estimated in Section 4.1, are written as  $u_t = (u_t^y, u_t^p, u_t^i, u_t^{neer})'$ ,

while the structural shocks are denoted as  $\varepsilon_t = (\varepsilon_t^y, \varepsilon_t^p, \varepsilon_t^i, \varepsilon_t^{neer})'$ .

The *AB* model<sup>17</sup> is given by

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<sup>17</sup> We also estimate the structural VAR model based on the five-variable model of Section 4.1. Due to the limitations of economic theory, we use the recursive causal ordering method suggested by Christiano et al. (1999) to identify the VAR system. For simplicity and space, this result is not reported but is available upon request.



$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ 0 & a_{32} & 1 & 0 \\ a_{41} & a_{42} & a_{43} & 1 \end{bmatrix} \begin{bmatrix} u_t^y \\ u_t^p \\ u_t^i \\ u_t^{neer} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 \\ 0 & 0 & b_{33} & 0 \\ 0 & 0 & 0 & b_{44} \end{bmatrix} \begin{bmatrix} \varepsilon_t^y \\ \varepsilon_t^p \\ \varepsilon_t^i \\ \varepsilon_t^{neer} \end{bmatrix}. \quad (8)$$

To estimate this system, we need to make an identification assumption based on economic theory. Following Sims and Zha (1995) and Rotemberg and Woodford (1999), we assume that real activities do not react immediately to price and financial variables changes, as the first row of Equation (8) indicates. This assumption is consistent with empirical evidence that the adjustments of real economic activities are subject to inertia and are costly. Due to the rigidity of price adjustments, the second row of Equation (8) specifies that price reacts to financial shocks, i.e., both monetary supply and exchange rate shocks, with a lag. Our specification is consistent with the argument of Rotemberg and Woodford (1999), who suggest that the adjustment of real output and price to monetary shocks occurs with a delay. Capital controls of the RMB, although still pegged to the U.S. dollar, still allow the Chinese monetary authority to have partial independence of monetary policy.<sup>18</sup> Hence, we assume that monetary policy does not react contemporaneously to exchange rate shocks. The monetary policy response function which sets the interest rate after observing the price level but not the exchange rate and the current value of output is identified in the third row of Equation (8). As with Sims and Zha (1995), information delays do not allow a monetary policy response within the period (the quarter in our data) to output growth. Finally, following Kim and Roubini (2000), we assume that the exchange rate in the VAR model responds contemporaneously to all the variables.<sup>19</sup> The exchange rate equation is identified in the fourth row of Equation (8).

Table 7 reports the structural estimates of the  $A$  and  $B$  matrix

<sup>18</sup> Prasad and Rajan (2006) suggest that as the Chinese economy becomes more complex and integrated with the global economy, the restrictions on capital accounts become more porous as evading controls becomes much easier through channels such as trade credit and underground banks.

<sup>19</sup> Kim and Roubini (2000) suggest that the exchange rate is a forward-looking asset price. The exchange rate equation is an arbitrage equation describing the financial market equilibrium.

across the two periods. Consistent with our expectations, the estimated values of  $a_{32}$  are negative in both periods. This implies that the Chinese monetary authority took a contraction position in response to a shock in the inflation rate. The likelihood ratio of the overidentification test reports that the  $\chi^2(1)$  test statistics for Period I and Period II are 1.69 and 2.17, respectively, with corresponding  $p$ -values of 0.194 and 0.141. This shows that our structural VAR model is not overidentified.

Table 7. Estimates of Structural Parameters

Parameter	Period I		Period II	
	Coefficient	S.E.	Coefficient	S.E.
A_21	-0.492	0.162	-0.194	0.087
A_41	-0.516	0.488	0.630	0.254
A_32	-0.022	0.027	-0.072	0.059
A_42	0.832	0.359	0.822	0.361
A_43	-4.192	1.567	1.517	0.744
B_11	1.676	0.151	1.164	0.105
B_22	2.136	0.192	0.798	0.072
B_33	0.487	0.044	0.383	0.034
B_44	6.012	0.540	2.243	0.201
Chi-squared	1.69		2.17	
$p$ -value	0.194		0.141	

**Note:** We use the last quarter of 1994 as the break point to separate the sample into two periods: Period I (1979:Q1-1994:Q4) and Period II (1995:Q1-2010:Q4). The chi-squared test is the overidentification test for the structural VAR model.

Table 8 reports the results of the counterfactual simulations with structural parameters and shock processes estimated in different periods. It shows that when Period II structural shocks are taken into the Period I economic model, the standard deviation of output growth rate falls dramatically from 4.384 to 2.477. Meanwhile, when Period II's economic structure is subject to Period I's shocks, output volatility increases substantially from 1.947 to 3.101. Roughly 47.4

to 78.2 percent of the reduction in output volatility can be explained by the smaller random shocks. Consistent with our previous findings, our structural VAR analysis confirms that reduced shocks hitting the economy contributes the most to the decline in volatility in the post-1994 period; the good luck hypothesis finds further support.

Table 8. Unconditional Standard Deviation Using  
SVAR

Parameters	Shocks	Four-Variable Quarterly Model			
		GDP	CPI	Interest Rate	NEER
Period I	Period I	4.384	8.752	2.068	16.381
Period II	Period II	1.947	2.656	1.153	5.280
Period I	Period II	2.477	5.008	1.605	10.624
Period II	Period I	3.101	5.506	2.038	12.838

**Note:** We consider macroeconomic time series data from the first quarter of 1979 to the last quarter of 2010. NEER denotes the nominal effective exchange rate. Except for the interest rate, all other variables are quarterly year-on-year growth rate and are seasonally adjusted. Total observations are 128. We use the last quarter of 1994 as the break point to separate the sample into two periods: Period I (1979:Q1-1994:Q4) and Period II (1995:Q1-2010:Q4).

## 5. Conclusion

The economic volatilities observed in China have been markedly lower since the mid-1990s. We analyze three possible explanations for this economic moderation: good policy, good business practices and milder economic shocks. In particular, we investigate their respective contributions to the decline in macroeconomic volatility by using frequency domain and VAR analysis. The results of our frequency domain analysis show that most of the variance reduction of real GDP growth rate and CPI inflation rate is due to smaller shocks to the economy. Better policy and business cycle practices have only a marginal impact on smoothing economic volatility.

To complement the frequency domain analysis, we use a standard VAR model, and conduct a counterfactual analysis to further investigate the role of good policy and business practices in

smoothing the economy. Still, the results are consistent with the good luck hypothesis, i.e., that reduced random shocks account for most of the reduction in output volatility. Our results are robust for either a structural VAR model or a five-variable model that distinguishes between final sales and inventory.

Our results have a number of policy implications and call into question the sustainability of the growth of China's economy. Over the last three decades, the growth of the Chinese economy has been remarkable, but heavily reliant on its incremental and experimental approach to economic reform. This reform is underpinned by a dual track, where a planned track is maintained while introducing a market track, which provides opportunities for economic agents to be better off without creating losers in absolute terms (Lau et al. 2000).

This strategy serves China well during the reform period, but it involves a number of institutional distortions and constraints (Prasad and Rajan, 2006). For example, although reformed, China's currency regime is still *de facto* inflexible, and extensive capital controls remain. Most funds are channeled to SOEs at a cheap interest rate, while small- and medium-sized enterprises have limited financing opportunities from bank loans and capital markets. As China becomes more developed and complex, numerous institutional deficiencies and policy distortions may themselves become a source of instability, and eventually reduce the capacity of the Chinese economy to withstand and recover against any large economic shocks (Prasad, 2008).

Although Chinese economic growth is high and relative stable in the post-1994 period, our results indicate that this is largely due to good luck, or to milder shocks to the Chinese economy. Nevertheless, good luck has a tendency to run out and subsequent bad luck would severely disrupt the Chinese economy and social stability. China needs to improve its resilience to large shocks before this happens. Perhaps the best way forward is for China to develop more flexible, market-based policy tools as well as to reduce resource misallocation by channeling more funds to the private sector.<sup>20</sup> Well-designed government policies aimed at improving policy effectiveness and

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<sup>20</sup>Hsieh and Klenow (2009) provide evidence that adjusting China's resource allocation to reflect U.S. efficiency would increase total factor productivity by 30 to 50 percent.

business practices will allow the Chinese economy to cope with any unforeseen risks, or bad luck, and will ensure the sustainable growth of China's economy.

### **Appendix. Data Description**

This paper employs quarterly data series from the first quarter of 1979 to the fourth quarter of 2010. Most of data are from the CEIC database, while the real GDP growth rate is taken from Abeysinghe and Rajaguru (2004). As several quarterly series of variables are not available before 1990, we first draw yearly series of these variables from CEIC, and then used the Chow-Lin method (1971) for temporal disaggregation by transforming series from annual into quarterly data. Variables are seasonally adjusted by the Census X-12 ARIMA method. Growth rate refers to the quarterly year-on-year growth rate. The data we use in this paper are reported below.

No.	Data Series	Source
1	Growth Rate of Real GDP	Abeysinghe and Rajaguru (2004) before 1992, CEIC after 1992.
2	Growth Rate of Real Primary Industry Products	Yearly observations are drawn from CEIC, and is transformed from annual to quarterly observations before 1992. Quarterly observations are drawn from CEIC after 1992.
3	Growth Rate of Real Secondary Industry Products	Yearly observations are drawn from CEIC, and are transformed from annual to quarterly observations before 1992. Quarterly observations are drawn from CEIC after 1992.
4	Growth Rate of Real Tertiary Industry Products	Yearly observations are drawn from CEIC, and are transformed from annual to quarterly observations before 1992. Quarterly observations are drawn from CEIC after 1992.
5	Consumer Price Index	Yearly observations are drawn from CEIC, and are transformed from annual to quarterly observations before 1985. Quarterly

		observations are drawn from CEIC after 1985.
6	Final Sales Growth	The growth rate of Retail Sales of Consumer Goods. Yearly observations are drawn from CEIC, and are transformed from annual to quarterly observations before 1985. Quarterly observations are drawn from CEIC after 1985. Deflated by the Consumer Price Index.
7	Fixed Asset Investment Growth	Yearly observations are drawn from CEIC, and are transformed from annual to quarterly observations before 1985. Quarterly observations are drawn from CEIC after 1985. Deflated by the GDP deflator.
8	Inventory Growth	Yearly observations are drawn from CEIC, and are transformed from annual to quarterly observations. Deflated by the GDP deflator.
9	Nominal Effective Exchange Rate (NEER)	CEIC
10	Interest Rate	One-year lending rate, CEIC.

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# Inflation and Economic Growth: A Hump-shaped Relationship<sup>\*</sup>

By LIU XIANGBO<sup>\*</sup>

*Existing empirical evidence suggests that the relationship between inflation and long-run growth can be hump-shaped. However, the theoretical literature has mainly focused on either a negative or a positive impact of inflation on growth. Our paper revisits the relationship using Barro (1990) framework and finds that the nonlinear hump-shaped relation can be achieved. (JEL classification: E52; O41)*

## 1. Introduction

The nature of effects of inflation on long-run growth has long been a subject of debate. The theoretical literature has produced mixed results. On the one hand, Tobin (1965) argues that inflation can enhance accumulation of capital because it lowers interest rate. Therefore, inflation is beneficial to growth. On the other hand, Stockman (1981) proposes that with a binding cash-in-advance constraint on both consumption and private investment, inflation causes physical capital to decline, which in turn depresses the economic growth. More recently, subsequent research has examined the effects of inflation through distorting the accumulation of human and physical capital, through inserting real money balances into production function, and through credit market. Examples of this include Gillman and Kejask (2005), Gylfason and Herbertsson (2001), and Bose (2002). However, most existing models deliver either a positive or a negative effect of inflation on growth.<sup>1</sup>

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<sup>1</sup> A few exceptions include Paal and Smith (2001) and Vaona (2012). Paal and Smith (2001) emphasize the role of credit market in determining the hump-shaped relation between money growth and economic growth, whereas Vaona (2012) explores this relationship by merging a

On the empirical side, there has been substantial empirical work on the relationship between inflation and growth. Many studies (see, among others, Gylfason 1991; Fischer 1993; Ghosh and Philips 1998; and Burdekin *et al.* 2004) find a threshold effect of inflation on growth. When inflation is lower than the threshold, inflation produces a positive effect on growth, whereas the relationship becomes negative when money growth is above it. Therefore, inflation has a nonlinear (hump-shaped) effect on growth.

The objective of this paper is to provide a number of forces that work in opposite directions to determine the effects of inflation. To achieve this, the current study generalizes the productive government expenditure model la Barro (1990) by allowing government expenditure to be financed by both income tax and seigniorage. We propose that using seigniorage as a means of financing government expenditure is important for many underdeveloped countries.<sup>2</sup> At the same time, the threshold effect tends to be more evident in those countries. With a binding cash-in-advance constraint as in Stockman (1981), money growth affects the long-run growth in two ways. First, it decreases the economic growth by reducing the accumulation of physical capital. Second, money growth adds to productive government expenditure that is growth-enhancing. Therefore, the effect of inflation on growth is determined by the relative magnitude of these two forces which work in opposite directions. We find that money growth can have a hump-shaped relationship with the long-run growth rate. Faster money growth raises economic growth if money growth rate is lower than the threshold, whereas it retards economic growth if its growth rate is higher than the threshold.

## 2. The Model

### 2.1 Households

We consider an economy that consists of a unit measure of identical and infinitely-lived households and a government. Each

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growth model with a New Keynesian one with sticky wage. However, the mechanisms at work in these studies are quite different from the ones that we consider in our paper.

<sup>2</sup> Cukierman et al. (1992) show that the fraction of seigniorage in government revenue in some countries can be as large as 28%.

household derives utility from consumption, and maximizes its lifetime utility:

$$\sum_{t=0}^{\infty} \beta^t \ln C_t, \quad 0 < \beta \leq 1,$$

where  $C_t$  is the individual household's consumption,  $\beta$  denotes discount factor, and labor supply  $L_t$  is inelastic and normalized to unity. The budget constraint faced by the representative household is:

$$C_t + \frac{M_{t+1}}{P_t} + K_{t+1} - (1 - \delta)K_t = (1 - \tau)(w_t L_t + R_t K_t) + \frac{M_t}{P_t}, \quad 0 < \tau, \delta \leq 1, \quad (1)$$

where  $K_t$  denotes the stock level of physical capital,  $M_t$  is the nominal money supply,  $P_t$  represents the aggregate price level,  $\delta$  denotes the capital depreciation rate,  $w_t$  is the real wage rate,  $R_t$  denotes the rate of return on capital and is the income tax rate. Denote real money holdings and the inflation rate by  $m_t = M_t/P_t$ , and  $\pi_{t+1} = P_{t+1}/P_t$ , respectively. Following Stockman (1981), the representative household also faces a cash-in-advance constraint as follows:

$$C_t + K_{t+1} - (1 - \delta)K_t \leq \frac{M_t}{P_t}. \quad (2)$$

The first-order conditions for the representative household and the associated transversality conditions are:

$$C_t : C_t^{-1} = \lambda_t + \varphi_t, \quad (3)$$

$$M_{t+1} : \frac{\lambda_t}{P_t} = \beta \left( \frac{\lambda_{t+1}}{P_{t+1}} + \frac{\varphi_{t+1}}{P_{t+1}} \right), \quad (4)$$

$$K_{t+1} : \lambda_t + \varphi_t = \beta \left[ (\lambda_{t+1} + \varphi_{t+1})(1 - \delta) + \lambda_{t+1}(1 - \tau)R_{t+1} \right], \quad (5)$$

$$TVC_1 : \lim_{t \rightarrow \infty} \beta^T \lambda_{t+T} K_{t+T+1} = 0,$$

$$TVC_2 : \lim_{t \rightarrow \infty} \beta^T \varphi_{t+T} \frac{M_{t+T+1}}{P_{t+T+1}} = 0,$$

where  $\lambda_t$  and  $\varphi_t$  are the Lagrangian multipliers associated with the budget constraint and the cash-in-advance constraint, respectively. Eq. (3) is the standard condition which equates the marginal benefits of consumption to its marginal costs. Eq. (4) states that the marginal values of real money holdings are equal to their marginal costs. Eq. (5) reveals that the rate of return on consumption equals the after-tax rate of return on capital.

## 2.2 Production

There is a large number of identical firms in this economy. In line with Barro (1990), in each period, each firm is assumed to produce output using capital  $K_t$ , labor  $L_t$  and the government's expenditure  $G_t$ . We further assume that government's expenditure is labor augmenting and the production function is given by

$$Y_t = AK_t^{1-\alpha}(G_t L_t)^\alpha. \quad (6)$$

Taking factor prices and the government's expenditure as given, the representative firm chooses  $L_t$  and  $K_t$  to maximize its profits. Interior solutions of the firm's problem are characterized by the first-order conditions as follows:

$$\begin{aligned} w_t &= \alpha AK_t^{1-\alpha} L_t^{\alpha-1} G_t^\alpha, \\ R_t &= (1-\alpha)AK_t^{-\alpha} L_t^\alpha G_t^\alpha. \end{aligned}$$

## 2.3 Government

In each period, the government expenditure is financed by the income tax as well as seigniorage. Therefore, we express the government's budget constraint as follows:

$$G_t = \tau(w_t L_t + R_t K_t) + \frac{M_{t+1} - M_t}{P_t}. \quad (7)$$

On the monetary side of the economy, nominal money supply is assumed to grow at a constant rate and thus money supply evolves according to

$$M_{t+1} = (1 + \mu)M_t. \quad (8)$$

## 3. Balanced Growth Path

In this section, we examine the economy's balanced growth path, along which output, consumption, physical capital, government expenditure and real money balances all grow at a common constant rate denoted by  $\gamma$ : Based on Eqs. (1), (2) and (3), we can have

$$C_t^{-1} = \beta \left[ C_{t+1}^{-1} (1 - \delta) + \beta \frac{C_{t+2}^{-1}}{1 + \pi_{t+2}} (1 - \tau)(1 - \alpha) \frac{Y_{t+1}}{K_{t+1}} \right]. \quad (9)$$

Dividing both sides of Eq. (9) by  $C_{t+1}^{-1}$  gives rise to the common growth rate as

$$1 + \gamma = \beta \left[ (1 - \delta) + \beta \frac{(1 - \tau)(1 - \alpha)}{(1 + \gamma)(1 + \pi)} \frac{Y_{t+1}}{K_{t+1}} \right]. \quad (10)$$

Combining Eqs (1), (2), (6), (7) and (8), we derive the expression for  $Y_{t+1}=K_{t+1}$  as follows:

$$\frac{Y_{t+1}}{K_{t+1}} = A^{\frac{1}{1-\alpha}} \left[ \tau + (1 - \tau) \frac{\mu}{1 + \mu} \right]^{\frac{\alpha}{1-\alpha}} \equiv \frac{Y}{K}. \quad (11)$$

Similarly, combining Eq. (8) and the definition of inflation rate gives the following relationship

$$1 + \mu = (1 + \gamma)(1 + \pi). \quad (12)$$

Substituting Eqs. (11) and (12) into Eq. (10), the expression of the common growth rate is given by

$$\gamma = \beta(1 - \delta) + \beta^2 \frac{(1 - \tau)(1 - \alpha)}{1 + \mu} A^{\frac{1}{1-\alpha}} \left[ \tau + (1 - \tau) \frac{\mu}{1 + \mu} \right]^{\frac{\alpha}{1-\alpha}} - 1.$$

Differentiating the common growth rate with respect to money growth rate gives rise to the following:

$$\frac{\partial \gamma}{\partial \mu} = \beta^2 A^{\frac{1}{1-\alpha}} (1 - \tau)(1 - \alpha) \frac{\left(1 - \frac{1-\tau}{1+\mu}\right)^{\frac{\alpha}{1-\alpha}}}{(1 + \mu)^2} \left[ \frac{\alpha}{1 - \alpha} \frac{1 - \tau}{(1 + \mu)(1 - \frac{1-\tau}{1+\mu})} - 1 \right] \geq 0, \text{ only if } \mu \leq \frac{\alpha - \tau}{1 - \alpha}.$$

Clearly, an increase in money supply exhibits a nonlinear effect on economic growth. On the one hand, it adds to productive government expenditure which is growth-enhancing. On the other hand, an increase in money growth reduces long-run growth. As in Stockman (1981), with a binding cash-in-advance constraint on both consumption and private investment, inflation causes physical capital to decline, which in turn depresses the economic growth. The results in here show that the positive force dominates when money growth is small so that long-run growth increases as increases. However, when money supply continues to grow, the negative force will eventually override the positive one so that long-run growth is decreasing with.

**Proposition 1** *When productive government expenditure is financed by income tax and seigniorage, money growth/inflation can have a hump-shaped relationship with the long-run growth rate. Faster money growth raises economic growth if money growth rate is lower than the threshold  $\mu_1$ , whereas it retards economic growth if its growth rate is higher than the threshold.*

#### 4. Conclusion

Our paper reexamines the relationship between money growth and economic growth using Barro (1990) framework in which productive government expenditure is financed by income tax and seigniorage. We find that money growth affects the long-run growth in two ways. First, it decreases the economic growth by reducing the accumulation of physical capital. Second, money growth adds to productive government expenditure that is growth-enhancing. Furthermore, we show that money growth can have a hump-shaped relationship with the long-run growth rate. Faster money growth raises economic growth if money growth rate is lower than the threshold, whereas it retards economic growth if its growth rate is higher than the threshold.

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## IMI News

### IMI Holds the Annual Academic Committee and Plenary Meeting, 2013



On January 19, the IMI Annual Academic Committee and Plenary Meeting 2013 was held at Renmin University. Over 40 participants attended the meeting including Professor Chen Yulu, director of IMI Academic Committee, president of Renmin University. The meeting was hosted by Mr. Ben Shenglin, Executive director and council member of IMI and chief executive officer of JP Morgan Chase Bank (China) Company Limited. The themes of the meeting covered two sections: 2013 work summary and the outlook of 2014 work planning of the Institute; appointment extension of the IMI Advisory Board members and appointment of Academic Committee members and management team. The participants proposed constructive ideas and suggestions regarding future development and planning of the Institute through the discussions of four topics: systematic and professional development of academic activities; mode innovations

of the publicity and achievements transformation; systematic and international development of the scientific research and international communications; publicity of the “Annual Report on the Internationalization of RMB”.

## **IMI Roundtable Winter 2013 and Spring 2014**

### **Editor's Note:**

*IMI Roundtable is a high-level quarterly forum initiated by IMI. The forum invites domestic and overseas financial experts, and overviews the reform of monetary and finance, hoping to provide feasible suggestions for the establishment and implementation of China's international financial strategies. The previous keynote speakers include: Mr. WEI Jianguo, vice minister of the Ministry of Commerce; Mr. SU Ning, deputy-governor of PBC; Yves Mersch, governor of Central Bank of Luxembourg; Patrick Honohan, governor of Central Bank of Ireland; David Marsh, chairman and co-founder of OMFIF. Currently, the forum has become a significant platform for academic exchanges in the monetary and financial discipline, and has cast great impact on financial theoretical and practical circle.*

## **“IMI Roundtable • Winter 2013” Probing into the Challenges and Opportunities Faced by RMB Internationalization**



On January 11, “IMI Roundtable • Winter 2013” was held in Shenzhen, jointly sponsored by International Monetary Institute and the Alumni Association of Renmin University. The theme of the forum was “New Age of RMB Internationalization after the Third Plenary Session”. Over 60 scholars and experts attended the forum including: Mr. Song Hai, vice chairman of China National Democratic Construction Association, Standing Committee member and deputy secretary general of the CPPCC, former vice governor of Guangdong Province; Professor Tu Yonghong, vice director and council member of IMI; etc. The conference was hosted by Mr. Ben Shenglin, chief executive officer of JP Morgan Chase Bank (China) Company Limited.

Keynote speakers, Mr. Zhang Jianjun and Professor Tu Yonghong, elaborated the significance of RMB internationalization in several aspects involving the challenges and opportunities, the feasible path under the new monetary and financial structure, and the impact on national security, economy and military field. Panel speakers, Mr. Song Hai and Mr. Wei Benhua proposed

many constructive suggestions concerning the feasible path of RMB internationalization after the Third Plenary Session.

**“IMI Roundtable • Spring 2014” Focusing on Emerging Markets’  
Currency Crisis**



On March 15, “IMI Roundtable • Spring 2014” was held in Room 830 at Mingde Main Building, under the theme of “Emerging Markets’ Currency Crisis”. Over 60 participants attended the forum including Mr. Wei Benhua, former deputy-in-bureau of the State Administration of Foreign Exchange. The conference was hosted by Mr. Ben Shenglin, executive director and council member of IMI, chief executive officer of JP Morgan Chase Bank (China) Company Limited.

The participants conducted discussions of the following issues: the history of emerging markets’ currency crisis, analysis and predictions of the currency crisis, balance sheets analysis, and fluctuation characteristics of new emerging markets’ currency crisis and the enlightenment to China; the exploration of the new pattern of financial operations for the purpose of establishing strategies meeting the demand of national development; financial regulation’s searching for the solution of “too big to fall”.

## IMI Biweekly Seminars

### Perspectives on the Currency Swap Agreement of the Federal Reserve System



The seventh IMI Biweekly Seminar was held on December 5, 2013 in Room 602 at Culture Square, hosted by Mr. Xu Yisheng, researcher of IMI, under the theme of “Perspectives on the Currency Swap Network of the Federal Reserve System”. Financial experts and the plenary researchers of IMI attended the forum including Mr. Xia Bin, honorary director of the Research Institute of Finance, Development Research Center of the State Council.

On October 31, 2013, six central banks (FRS, European Central Bank, Bank of England, Bank of Japan, Bank of Canada and the Swiss National Bank) transformed the temporary bilateral liquidity swap agreement to the long-term based currency swap agreement. According to an announcement of FRS, once two of the six central banks consider the market conditions favorable for the swap, the central bank with liquidity demands may obtain liquidity of the five other currencies from the corresponding banks.

The forum developed discussions of perspectives on this new mechanism and the following issues: FRS becoming the lender of last resort (LLS) for some economic entities, the impact of FRS’s LLS

function on international monetary system, and the response of emerging markets, especially China, to this new structure.

### **Opening of the First IMI Biweekly Seminar in 2014**



On March 2, the first IMI Biweekly Seminar in 2014 was held in Room 602 at Culture Square, with the topic of “China’s experience of economic reform from the perspectives of the relation between the market and the government”. The forum was hosted by Mr. Ben Shenglin, executive director and council member of IMI, chief executive officer of JP Morgan Chase Bank (China) Company Limited.

Keynote speaker, Professor Zhang Jie, associate dean of the School of Finance, director and council member of IMI, explored the reason for China’s fast and steady economic growth from the perspectives of “comparative advantage” and “high saving rate”; meanwhile, he proposed the idea that the equilibrium of the government and the market system boosts China’s economic growth. Professor Zhang briefly introduced domestic and overseas research on “market and government” and elaborated his research on the cooperative path of individual and government combining the elements of western and eastern history, culture and philosophy. His research demonstrated that the equilibrium of the government and the market system is the

important reason for China's economic growth; therefore, the incremental economic reform is a historical necessity. He further pointed out that western economics, without the government factor, could not explain economic phenomena anymore, therefore he encouraged young people to explore more of the new economics involving East Asia and China's experience considering the government factor, and to create the new economics form that meets the demands of time development and carries the Chinese characteristics.

## **News on RMB Internationalization**

### **Editor's Note:**

*RMB Internationalization is a key research area of IMI. Since the first issue of the "Annual Report on the Internationalization of Renminbi, 2012" and the initiate of RII, IMI has been composing and releasing the Report for consecutive years. This year, the "Annual Report on the Internationalization of Renminbi, 2014" set the topic on RMB internationalization and the construction of offshore RMB markets.*

### **IMI Research Team of RMB Internationalization Investigates Offshore RMB Markets in Shenzhen and Hong Kong**

On January 13 and 14, IMI Research Team of RMB Internationalization went to Shenzhen and Hong Kong for investigation of the construction of offshore RMB markets.

In Shenzhen, the research team visited Shenzhen Central Sub-branch of PBC, Authority of Qianhai Cooperation District of Shenzhen-Hong Kong Modern Service Industry, Authority of Qianhai Bay Bonded Area, and conducted panel discussion with experts at China Merchants Bank. According to the experts, the construction of offshore RMB markets plays a positive role in RMB internationalization and China's development of trade and economy;



Shenzhen should open her mind for development, promote reform, break through the obstructions, clarify the functions of Qianhai, and establish the channel of RMB backflow under the support of Hong Kong offshore RMB market.

In Hong Kong, the research team visited the Office of Academic Links at the Chinese University of Hong Kong, JPMorgan Chase Bank Company Ltd., Bank of China (Hong Kong) and HSBC. The team probed into the field of RMB internationalization, the construction of offshore RMB markets, and financial reform and innovation.

The team obtained plenty of first-hand data references through the investigation.

### **The Dynamics and Outlook for RMB Internationalization: the RII is estimated to climb to as high as 1.88 by the end of 2014**

On March 31, Seminar of “The Dynamics and Outlook for RMB Internationalization” and Presentation on Stage Achievements was held in Room 602 at Culture Square, participants including Professor Tu Yonghong, vice director and council member of IMI.

Professor Tu presented and elaborated the report of “the Dynamics and Outlook for RMB Internationalization” on behalf of the research team. According to the Report: China’s economy grew steadily in 2013; financial reforms advanced in an orderly manner; policies guiding the cross-border use of the RMB experienced breakthroughs and improvements; international trade and financial cooperation deepened; offshore markets developed very rapidly. Five main pillars have come together to push RMB internationalization into the next phase. It is estimated that the RII will climb to as high as 1.88 by the end of 2014. The RMB’s level of internationalization is estimated to exceed Japanese Yen and British Pound. This seminar is the first presentation on the stage achievements report for the first quarter of 2014.

### **“2014 Report of RMB Internationalization” First Draft Probes into RMB Internationalization and the Construction of Offshore**



## **Markets**

On March 29, the Approval Meeting of the First Draft of “Annual Report on the Internationalization of RMB” was held in Room 801 at Mingde Main Building. Professor Chen Yulu, president of Renmin University, chief editor of the Report, attended the meeting. The host was Professor Zhao Xijun, associate dean of the School of Finance, Renmin University.

The meeting examined the arrangement of the chapters, data restrictions, constructions of offshore markets and other issues. Professor Tu Yonghong, vice director of IMI, briefly introduced the topic selections, the contents and features of the report and problems to be solved. According to professor Tu, the stage achievement report will be presented quarterly starting from 2014. The participants fully affirmed the report and provided constructive suggestions on the adjustment of chapters, detailed expressions of relevant items, and economic and policy issues. President Chen Yulu expressed the confidence to improve the report and make it to the new growth point of financial development of Renmin University.

### **Issuance of the “Report on the Internationalization of RMB (Japanese Edition)” Attracts Broad Attention in Japan**

The “Report of RMB Internationalization (Japanese Edition)” was issued in the beginning of 2014 and attracted broad attention in Japan. The book was written by IMI with the chief editor president Chen Yulu. The most authoritative economic newspaper “NIKKEI Asian Review” published an article titled “Strategic Interpretation of the World’s Third Major Currency” covering the issuance of the book. The article stated that the book explicated the breakthrough of RMB Internationalization and the current reality and future projects from a calm and objective perspective.

The book was published by Science Press (Tokyo) Ltd. The main publications of the Press are academic works in the discipline of social science and political economics, scientific and cultural relic illustrated handbooks, and historical cultural works, which adapt a

language style and layout design that suit the local readers. The publications of the Press provide detailed and reliable materials for Japanese readers to understand the real China. Economic professionals in Japan concern very much about the strategic orientation of RMB as the currency of the second largest economy in the world. “Report on the Internationalization of RMB (Japanese Edition)” demonstrated the mid-to-long-term currency strategies of the Chinese government.



# Call for Papers

## International Monetary Review

International Monetary Review is an internal academic magazine sponsored by International Monetary Institute. Following the principle of including both Chinese and western merits with precise and practical academic spirit, International Monetary Review focuses on the cutting-edge theoretical researches in internationalization of RMB, reform of international monetary system, regional monetary and financial cooperation, China's international financial strategies, and other macro-financial theories and policies.

We welcome submissions by scholars, experts and practitioners in financial industry. Papers and articles should center on key financial issues and follow academic standard and scientific methodology. We welcome quality articles based on data analysis and theoretical model and other insightful articles with standard writing.

### Prepare your article

**General rule:** Submitted manuscripts should be double-spaced texts in 10.5 point font, and formatted for paper of standard size with margins of at least 20mm on all sides. Pages should be numbered, and an abstract (of no more than 200 words), as well as keywords and complete author affiliations, should be included in the paper in the title page. A regular article should not exceed 50 pages.

**Mathematics:** Equations must be identified by consecutive Arabic numbers in parentheses on the right. Expressions should be aligned and compound subscripts and superscripts clearly marked if there is any potential for confusion.

**Figures:** Figures must be of professional quality and ready for reproduction. They should be numbered consecutively. Black-and-white versions of figures are required for printing purposes, but color figures can also be supplied for online dissemination.

**Tables:** Tables should be numbered consecutively throughout the article. Each table must include a descriptive title and headings to columns. Gather general footnotes to tables as "Note:" or "Notes:", and use a, b, c, etc., for specific footnotes. Asterisks \* and/or \*\* indicate significance at the 5 percent and 1 percent levels, respectively, if used.

### Reference style

Please follow the EPS Style Guide when preparing your article.  
<http://eps.ruc.edu.cn/UserFiles/File/EPS%20Style%20Guide.pdf>

### Further considerations

- Manuscript has been spell-checked and grammar-checked
- References are in the correct format for this journal
- All references mentioned in the reference list are cited in the text, and vice versa
- Permission has been obtained for use of copyrighted material from other sources

### Submit your article

Manuscripts can be submitted via e-mail to [imi@ruc.edu.cn](mailto:imi@ruc.edu.cn)



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