

China After the Global Financial Crisis

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Guest Editors: Richard C. K. Burdekin, James R. Barth,
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Editorial

China after the Global Financial Crisis

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“Quand la Chine s’éveillera, le monde tremblera ...”

[“When China rises, the world will tremble ...”]

Napoleon Bonaparte [1]

“The maximum amount of bilateral trade possible between us ... is infinitesimal in terms of our economy”

Henry Kissinger, 1972 [2]

For decades China’s economic progress was stifled and hidden from the rest of the world behind Chairman Mao’s “bamboo curtain.” However, the remarkable growth over the post-1978 reform period has launched the country into a major player in the world economy. Although unforeseeable at the time of Nixon’s 1972 visit, the People’s Republic of China has become the United States’ second largest trading partner and its soaring bilateral trade surpluses (over \$273 billion in 2010) have repeatedly raised the ire of congress. In addition to maintaining real growth rates consistently close to 10% per annum, mainland China’s financial development has been such that four of the ten largest banks in the world based on market capitalization are Chinese, with the Industrial and Commercial Bank of China and China Construction Bank ranking first and second, respectively. Meanwhile, the Shanghai Stock Exchange, not reopened until December 1990, has seen its total market capitalization rise from less than \$0.3 trillion in 2005 to \$2.7 trillion at the end of 2010, putting it in fifth place among all world stock

exchanges. Shanghai also ranked in sixth position amongst the world’s top financial centers in the 2011 Dow Jones International Financial Centers Development Index, ahead of Paris and Frankfurt and just two places behind Hong Kong [3]. Even prior to the onset of the global financial crisis, many tough challenges remained for China, however. This included the sustainability of China’s exchange rate policy and the accompanying capital controls, ongoing concerns about nonperforming loans in its banking system, and the extreme boom-bust cycles seen in its equity and housing markets. The Shanghai A-Share Index, for example, after rising more than fivefold over the 2005–2007 period, plunged from its record high of 6395.76 in October 2007 to below 1900 in November 2008.

Whereas the global financial crisis that began in 2007 induced recessions in many western economies, Chinese growth remained quite robust despite the damage to many of the nation’s main export markets. Domestic demand was boosted by a huge fiscal stimulus package equivalent to \$600 billion (or 20% of China’s GDP) that was launched in November 2008 in conjunction with calls for the nation’s banks to boost their lending rates. Indeed, by 2009 concerns shifted toward avoiding inflationary pressures. The quite restrictive monetary stance of the People’s Bank of China since then stood in sharp contrast to the continued easy money policies of the US Federal Reserve System, which initiated yet more quantitative easing in 2010–2011 to address the lackluster growth in employment. China’s relative strength has also been accompanied by renewed controversy over the exchange rate between the renminbi and the US dollar. In resisting outside pressures to allow greater flexibility, Chinese officials point to the vulnerability of the banking and

financial system as well as the export job losses associated with any sharp appreciation in the national currency.

This special issue focuses on the impact of the global financial crisis on China and its economic prospects going forward. One of the key issues is the state of China's banking system and asset markets. Notwithstanding apparent strong performance, there has been concern about the rapidity of the lending growth rates seen since 2009 and the threat of asset price bubbles. Exchange rate pressures are another key challenge and it is important to consider whether renminbi appreciation is justified on the Chinese side rather than merely concentrating on how such a move might benefit the United States. Meanwhile, Chinese policymakers' shift from massive stimulus in 2008 to retrenchment in 2009 begs the question of why economic recovery was so much more immediate in China than in the Western world. It is also important to consider whether this rapid turnaround reflects a decoupling from events in the Western economies and the extent to which China's financial system remains relatively insulated today.

The paper authored by N. Zhang et al., in the special issue, focuses directly on how the global financial crisis has impacted mainland China's financial markets and macroeconomy. A major theme of the paper is that we should not be too ready to embrace the premise that China's growing economic strength has led to a true decoupling from developments in the advanced economies. Even though China may be exerting an increasingly large impact on the global economy, economic interdependence runs strongly in both directions. Indeed, the shortfall in China's growth in 2008 relative to its prior trend exceeded that experienced by the United States in absolute terms. A second theme of the paper is that, notwithstanding its heavy export dependence equal to roughly 40% of its GDP, China has been able to effectively boost domestic demand to reduce the negative effects of the global recession. This has not been without its costs, however. The expansionary policies have led to inflationary concerns, and the extraordinary gains in the real estate sector could well leave China at serious risk of a bursting asset price bubble. Meanwhile, more than half of the largest commercial banks reported over 10% growth in nonperforming loans over 2010-2011 while China's credit-to-GDP ratio rose from 120% at the end of 2008 to 166% by March, 2011. Other challenges include the disposition of China's massive, largely dollar-denominated foreign exchange reserves and how best to proceed with financial market liberalization and capital account liberalization without undue disruption. China's external role also needs reassessment and the nation must come to grips with its increasingly important role in promoting international and regional economic and financial cooperation.

The paper authored by N. Horesh examines the evolution of the renminbi as an international currency. Although not widely known, China played the role of international currency provider in the past. Traditional Chinese copper coins were a model for the early currencies of Japan and Korea and served as an East Asian and Southeast Asian monetary benchmark for a millennium or so before being displaced by western coinage in the late nineteenth century.

Chinese coins even circulated in India and Ceylon between the 7th and 14th centuries. Moreover, rather like today, financial assets long flowed into China from the West in the face of substantial Chinese trade surpluses. The question of how soon, and to what extent, China's currency will regain its old global role is heavily dependent upon the authorities' willingness to further relax capital controls and, most likely, accept additional renminbi appreciation. Thus far, Chinese policymakers have shied away from any overt challenge to the US dollar's reserve currency role and seem to envisage the renminbi being just one of many alternatives to the dollar in any potential new global standard. The author argues that the future role of the renminbi depends not only upon the pace of domestic reform but also upon the role China elects to play with respect to such international edifices as the IMF, World Bank, and the G20. Moreover, renminbi internationalization may not necessarily end up being as dependent upon the depth of domestic capital markets as was true under the establishment of previous hegemony under the pound sterling and its US dollar successor. We should not rule out a more distinct Chinese path to global economic eminence any more than we should forget that China's increasingly important role as a major global player is, after all, nothing new.

The paper authored by R. Burdekin and R. Tao examines the relationship between bank lending, inflation and China's stock market over the 2004-2010 period. There has been particular concern that rising reported bank profitability was occurring amidst substantial funds being used not in financing real economic activity but in speculation in the nation's stock and property markets. Such claims came to a head in 2009 with a surge in bank lending prompted by Chinese government efforts to support the economy during the global financial crisis. For the 2004-2010 period as a whole, People's Bank of China survey data on banking activity and inflation expectations are found to support a causal relationship between inflation expectations, banking activity, and the stock market. The results imply that fears of inflation amidst surging bank lending and share prices are neither misplaced nor just a figment of the 2009 experience alone. Banking business seems to be driven by stock market moves, and concomitant inflation concerns, rather than being the actual cause of any overheating that takes place, however. This leaves open the question of whether heightened bank lending is more a symptom than a cause of inflationary pressures in the economy, with the stock market seemingly moving before the banks. Nevertheless, stock market strength in China appears to carry with it not only rising inflationary concerns but also increased bank lending activity and reduced banker confidence that stable conditions will be maintained. This offers at least some justification for the People's Bank continuing to pay attention to the stock market in determining its monetary policy stance and suggests that the Shanghai index might actually serve as a useful indicator variable in China.

The paper by S. Zhou et al. employs a dynamic computable general equilibrium model to gain perspective on the impact of the government's stimulus package on the Chinese economy. This stimulus program, focusing primarily upon

housing projects and other infrastructure development, undoubtedly played an important role in supporting continued robust economic growth in 2008 and 2009 even amidst the worst of the global financial crisis. The authors' simulation analysis permits a comparison with how the Chinese economy might have fared had the stimulus program not been enacted when the financial crisis intensified in the fall of 2008. The basic dataset is a 2007 social accounting matrix incorporating a 135 sector input-output table and such other data as customs taxes, the international balance of payments, and flows of funds. The authors' estimates suggest that the GDP growth rate would have fallen to 2.36% in 2009 without the stimulus package before rebounding strongly in 2010. Expanding investment under the stimulus package is seen as the key driver in allowing for up to 9.1% growth in 2009. The estimated long-term impact of the stimulus package decays over time, however, producing an average 7.61% growth rate over 2011–2015 compared to 7.38% with no stimulus package and 7.94% if there had been no financial crisis in the first place. Meanwhile, sharp falls in exports and imports in 2009 followed by a rebound in 2010 are seen with or without the stimulus package. Consumption receives an estimated 1.5%–2% boost, however, while government income and household income also benefit. On the downside, the investment expansion brought about by the stimulus package adds to energy consumption and CO₂ emission, implying 2015 levels 1.9% and 2.3% higher than under the baseline scenario.

The paper by A. Strutt and T. Walmsley employs a dynamic global general equilibrium model to quantify the longer-term impacts of the financial crisis on the Chinese economy. This model incorporates such features as bilateral trade flows, consumer demand and intersectoral factor mobility, and foreign ownership of capital and investment behavior. The impact of endogenous capital accumulation can be captured under this approach along with the movement of investment between countries in response to changing expected rates of return. Following a common downturn during 2007–2011, the model's results suggest quite divergent longer-term effects on China compared to the United States, the European Union, and Japan in the aftermath of the financial crisis. In particular, higher relative returns on investment in China are seen inducing a substantial reallocation of investment towards China that encourages recovery there but only extends the growth declines experienced elsewhere. Overall global trade is seen falling by 13.7% relative to the 2020 no-crisis baseline case, while the composition of trade shifts in favor of investment goods and in line with the pattern of Chinese demand. The authors also consider the consequences that would follow if the crisis was more protracted and extended beyond 2011 into 2015. Although this naturally results in more severe output and export losses, a similar reallocation of investment towards China is predicted under this more adverse macroeconomic backdrop.

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Review Article

The Effects of the Global Financial Crisis on China's Financial Market and Macroeconomy

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This paper provides a brief review of the increasing importance of China in the world economy and discusses the spillover effects of the global financial crisis on China's financial markets and macroeconomy. It presents and critiques alternative ways of estimating these effects. Contrary to much popular discussion, China was hit fairly hard by the global recession generated by the financial crisis. It suffered a huge drop in exports, and these effects on the economy were only partially offset by China's huge stimulus program. While growth remained well above international averages, its drop was of the same order of magnitude as for the United States. The paper closes with a brief discussion of some of the major challenges facing China to rebalance its economy in order to sustain high growth.

1. Introduction

In the last two decades, China's economy has emerged as a major player in the world economy. China's high GDP growth has changed the distribution of economic activities across the world. It has passed Japan to become the second largest economy, and it is only a matter of time before it passes the United States. China's exports have lowered consumer prices across the globe, and its imports have begun to have a major impact on global commodity prices. China has become a major hub of intraindustry trade. From this point of view, China may become the engine of the world economy.

It is more important than ever to know how China responds to the global economy, especially the global financial crisis and ongoing concerns regarding US recession. This paper provides a brief review of China's economic position in the world economy, discusses the spillover effects of the global financial crisis on China's financial markets and the real economy, presents and critiques alternative ways of estimating these effects, and analyzes the reasons for the limited impact of the global crisis on China. One interesting result is that while China was not one of the countries hardest hit by the crisis, neither was it as insulated as many have assumed.

While its high growth rate during the crisis was the envy of most other countries, China's growth was substantially lowered by the crisis, suggesting that the decoupling of China's growth from the advanced countries may not be as great as many popular analyses have suggested. The paper also provides a discussion of the major challenges facing China for a sustainable growth.

2. China's Position in the World Economy

From 1978 to 2010, the share of China's GDP in the world economy increased from 1.7% to 9.5%, when valued at market exchange rates [1]. The share of China's GDP in the world economy is even higher if purchasing power adjusted prices were applied. This is due to both the differences between the prices of traded and nontraded goods that lead to an understatement of the real incomes of most developing countries and an exchange rate that it is widely (although not universally) viewed as being substantially undervalued. The increasing weight of China and the other emerging countries in the world economy not only has helped contribute importantly to global growth but also has helped diversify

the engines of global growth. This in turn over time should help contribute to greater stability in global growth.

Since the 1970s, the value of Chinese trade has approximately doubled every four to five years, gaining speed after the economic reforms launched in 1992. With this rapid growth, in 2010, China overtook Germany as the world's top exporter with exports worth about 1.5 trillion US dollars. By this time, China's share of world exports had risen to around 10%, up from 3% in 1999 [2], while the United States came in third behind Germany on the list [3]. Meanwhile, China's imports ranked third in the world at about 1.3 trillion US dollars in 2010. This rapid growth has transformed China from a negligible player in world trade to the world's leading exporter and a substantial importer [4].

China exports not only consumer goods but also electrical and other machinery, including data processing equipment, apparel, textiles, iron and steel, and optical and medical equipment, while its major imports include electrical and other machinery, oil and mineral fuels, optical and medical equipment, metal ores, plastics, and organic chemicals [5]. Since China serves as the most important assembly center for the world factory, its imports also include substantial quantities of parts and components that are subsequently incorporated into China's exports. (A recent study by Li [6] confirmed that intraindustry trade plays an important role in the transmission of business cycle synchronization, financial crisis, and spillover effects, by using both correlation approaches and dynamic factor models).

While China's exports have led to lower prices for consumers across the globe, this competition has also generated dislocations for many producers in other countries who in turn have been placing pressure on national governments to offer them protection against what they allege to be unfair competition. These pressures have been particularly strong in the United States and have been felt in many other countries as well.

In the US Congress, China's huge bilateral surplus with the United States has been a particular focus of attention. It is important to recognize, however, that in part because of China's important role as a center of intraindustry trade, this bilateral imbalance substantially overstates the amount of global disequilibrium that is being generated by China's super competitiveness. For example, China runs bilateral deficits with a number of Asian economies that provide inputs to its exporting firms. It should also be noted that a substantial promotion of China's exports are generated by multinational corporations, not just Chinese firms.

With China taking up more than 20% of world platinum and 17% of world palladium demand, news of the tightening policy from China had a swift downward effect on commodity prices and roiled world markets [7], while in countries such as the United States, most attention is paid to China's exports. However, China is also a major importer, especially of commodities. China's strong stimulus package during the global financial crisis resulting in strong import demand was an important prop for global commodities prices. The more recent concern about rising inflation has led to a substantial monetary tightening in China which has also had a major impact on commodity prices.

TABLE 1: China's annual GDP growth rates.

Year	2005	2006	2007	2008	2009	2010	2011 (estimated)
China	11.30	12.70	14.20	9.60	9.22	10.33	9.47

Source: IMF World Economic Outlook.

TABLE 2: China's net FDI in \$ billions.

Year	2005	2006	2007	2008	2009	2010
China	105.90	102.92	143.06	121.68	70.32	124.93

Source: World Bank World Development Index.

3. Spillover Effects of the Global Financial Crisis on China's Economy

The subprime financial crisis in the United States unleashed a series of severe effects from the stock market collapsing, financial institutions failing, and economies pushed in recession. The crisis spread from real estate to other sectors of economy and across the globe leads to the global financial crisis (for discussion of the spread of the crisis, see the analysis and references in Willett et al. [8]). Although China was able to maintain relatively high economic growth, the negative effects from the global financial crisis on China were considerably stronger than is often realized. This misconception arose largely because China continued to have one of the highest rates of economic growth across the globe, recording 9.6% in 2008 and 9.2% in 2009 (Table 1). What is typically missed is that, while most countries would be delighted to have such growth, these rates reflected a substantial drop from the 14.2% growth in 2007. This is discussed in more detail in Section 4. In terms of the falls in growth rate during the crisis period, China was hit hard as many of the advanced economies (see Willett et al. [9]).

The crisis spread through a number of channels. In the initial stages, financial channels were the most important. Financial institutions from a number of countries, especially in Europe, had invested heavily in securities linked to the US real estate market. These investors suffered huge losses. These investors generated a general flight to safety which led to large capital outflows from many emerging market economies that had few direct linkages with the US real estate market. China proved to be largely immune to these wealth and capital flow effects. FDI in China decreased during the beginning of financial crisis and rebounded to almost the precrisis level later on. As shown in Table 2, China's net FDI decreased to \$121.68 billion and \$70.32 billion in 2008 and 2009, dropping 15% and 42% year on year, respectively, and increased to \$124.93 billion in 2010.

However, there was also a global financial impact that did not operate directly through capital flows. The crisis affected the economic outlook and risk attitudes across the globe and China was not immune. Before the crisis, extreme optimism had affected many markets across the globe and China's stock market was no exception. Like in many other countries, China had enjoyed a stock market boom, increasing fivefold between 2005 and 2007. Such rapid growth makes markets

highly likely to suffer major reversals, and this is just what occurred when bad news hit.

Starting in October 2007, the stock market in China crashed, wiping out more than two-thirds of its market value [10]. A similar story applies to the real estate market. A bubble started to grow with China's booming economy, since most of the people believe that investing in property, such as real estate, is safer than putting money in the banks. The impacts of these developments on the Chinese economy were relatively small compared with the trade channel, however.

In its early stages, the magnitude of the crisis was substantially underestimated by most governments as well as private sector analysts. The adverse effects on the real economies were expected to be quite limited. Thus, it was believed that most emerging market economies would be little affected. This gave a bit boost to arguments that the behavior of emerging economy financial markets were decoupling from those of the advanced economies. However, as the crisis began to push the US and Europe into recession, the trade channel came to the fore. The falling demand in advanced economies had a huge impact on their demand for imports from each other and from emerging markets. With its past rapid growth in exports, China was especially exposed to falls in global demand for its exports.

In November 2008, China's export growth rate fell sharply to -2.2% from 20% in October. As a whole, China's exports fell by about 17% in 2009 [2], before recovering to positive growth in 2010, as the advanced countries began to grow again (Figure 1). The rebounds of economic growth in advanced countries have been modest, and this has limited the size of the rebound in China's exports. Although it remains too early to say that China's export business has leveled off [11], development of the domestic market will help maintain China's sustainable economic growth over the long term.

4. The Limited Impact of the Financial Crisis on China and the Decoupling View

Although the global financial crisis and economic downturn reduced foreign demand for China's exports substantially for the first time in many years, China has kept its relatively high growth rate during the crisis period. In 2010, China's economy rebounded, with GDP growth of around 10% outperforming all other major economies [5]. China's economy still has great potential despite the slight softening in 2011 that was noted earlier.

Due to its standout growth rate in the face of the global economic recession, China has set off a new round of discussions on the decoupling hypothesis. Careful analysis suggests, however, that while the rapid growth of economies such as Brazil, China, and India has substantially increased their influence on the global economies and especially on countries in their geographic regions, beliefs in a corresponding decline in the influence of the advanced economies were greatly overstated. The proper measure of the impacts of developments on a country's economic growth rate is how different the growth rate is from what it would otherwise have been. There is considerable scope for disagreements among

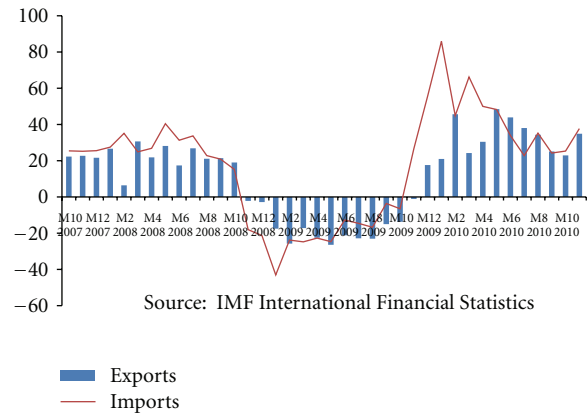


FIGURE 1: China's gross exports and imports growth.

TABLE 3: Deviations of GDP growth from the trend for China, India, and the US (linear trend from 2000 to 2006).

	China	India	US
2006	0.3	-0.2	-0.2
2007	1.2	-1.9	-0.7
2008	-3.4	-5.2	-2.5
2009	-4.4	-7.5	-5.7

Source: Willett et al. [9].

exports about just what the counterfactual would have been, but we can get a ballpark idea by comparing the changes in growth rates from before to during the crisis. Willett et al. [9] have investigated GDP growth and the stock markets in the United States and other advanced and emerging market economies during the global financial crisis through 2009 and find that, while countries like China and India had been able to maintain high growth rates, their shortfalls of GDP growth below past trends have not been that much different than for the United States itself. For example, in 2008, the deviation from trend of China's growth is -3.4 percentage points, even greater in absolute terms than the United States decline of 2.5 percentage points (although proportionately still less of a hit). In 2009, the rankings of deviations are reversed (Table 3). For the two years combined, the growth short falls are almost identical, 7.8 for China and 8.2 for the United States. Of course, different methods of detrending will give somewhat different figures so little weight should be given to the exact numbers calculated, but the broad conclusion that the declines for China and the US were roughly similar and robust (again, see Willett et al. [9]). That the impact on growth in China was roughly the same as in the country of origin clearly shows that not only does China now have a major impact on the world economy but that the world economy can have a major impact on it. Economic interdependence is a two-way street.

This should not be surprising since China's exports make up roughly 40% of its GDP and China depends heavily on western demand for its goods. The high level of export dependence implies that China is strongly coupled rather than

decoupled with the global economies, while on the financial side its restrictions have kept the strength of its coupling substantially weaker, although well above zero.

Given its high level of export dependence, the surprising fact about the performance of the Chinese economy during the global recession was not that growth slowed substantially but that it was able to remain so high. The reasons behind China's relatively high growth rate in global financial crisis are of interest to researchers and policy makers who are searching for strategies for reducing the damages of future financial crisis.

5. How Did China Maintain a High Growth Rate during the Crisis?

5.1. Strong Fiscal Position. In our judgment the key factor of China's high growth rate was its ability to quickly adopt a strong stimulus package. This in turn was feasible because of China's strong financial position.

In the Asian crisis of 1997-98, the crisis hit countries generally had weak financial sectors and low level of international reserves which sharply limited their ability to adopt stimulus policies in the face of their recessions. These countries learned a great deal from the crisis and substantially strengthened their financial systems and built up high levels of international reserves. Combined with sound fiscal positions, this gave many Asian economies considerable monetary and fiscal space to adopt substantial stimulus packages to help offset much of the decline in their exports. China is a prime example of this phenomenon.

Let us review China's strong financial position in more detail. Because of its solid position, China could afford to generate substantial fiscal and credit expansion. Over the past decade, China's budget deficits as percentage of GDP have been very small, staying less than 3 percent since 2000. In 2007, China even had a budget surplus. Even in the face of the massive stimulus package launched after the onset of the financial crisis, the 2008 and 2009 deficit to GDP ratios were still just 0.4 and 2.2 percent respectively, far smaller than most advanced countries (Figure 2).

When the crisis hit, the Chinese government took rapid countermeasures to mitigate the impact of the global financial crisis. Starting in the third quarter of 2008, the Chinese authorities adopted a combination of an active fiscal policy and a loose monetary policy by introducing an RMB 4 trillion (\$580 billion) stimulus package for 2009 and 2010 in November 2008. Those efforts to support the economy during the global financial crisis prompted a surge in bank lending. Bank lending in China totaled RMB 9.6 trillion in 2009, reaching nearly half of that year's GDP. Substantial funds from bank lending was funneled into the nation's stock and property markets rather than real economic activities, however, which contributed to the partial recovery of China's stock markets from the lows reached in early 2009 [12]. Even after adopting the expansionary fiscal policy, China's debt-to-GDP ratio was still lower than 20 percent at the end of 2009. In 2010, the Chinese central government budget deficit remained only 1.7 percent of GDP, as compared with 8.9

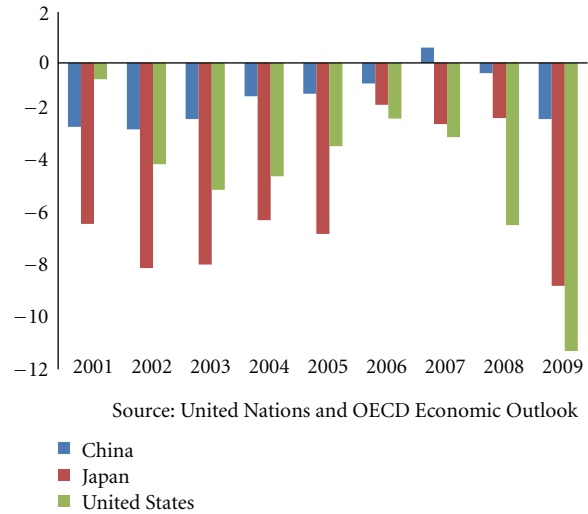


FIGURE 2: Government fiscal balance as percentage of GDP.

percent in the United States. These expansive policies had a major impact on the extent of the drop in growth.

5.2. A High Level of Foreign Exchange Reserves. In emerging market economies, highly expansionary monetary and fiscal policies frequently generate large balance of payments deficits which undermine confidence in their exchange rates and drain international reserves with low levels, so the feasibility of large stimulus policies can be highly constrained. High reserve levels on the other hand make substantial stimulus packages much more feasible. From this perspective China was in an incredibly strong position.

As of the first quarter of 2011, China held foreign exchange reserves of about \$3 trillion, the highest level in the world and three times that of the next largest holder, Japan. As suggested by Aizenman and Marion [13], international reserves and external borrowing are alternative ways of financing government spending in the face of sovereign risk. China could take advantage of its strong reserve position to adopt a large stimulus package without having to worry about high borrowing costs to fund its government spending, or generating a balance of payment crisis.

5.3. Limited International Capital Flow. Since WTO entry in 2001, China's controls over foreign banks and international capital flows have been reduced. While China has been gradually loosening its control on international financial flows, the regime is still quite restrictive. Despite much discussion of the various ways of evading these controls, they still have enough effectiveness to strongly limit international financial flows. While most economists argue that such controls carry efficiency costs, they can limit a country's exposure to international financial instability.

Most financing for development in China continues to be from domestic sources [14]. For example, the total assets of foreign-funded banks in mainland China was around \$193 billion at the end of March 2008, accounting for only roughly

2.4 percent of total bank assets in China [15]. Thus, foreign-funded banks remain too small to play an influential role in the financial system [16].

In addition, China has only slowly pursued liberalization of its domestic financial sector, and there has not been a great deal of financial innovations such as Mortgage-Backed Securities (MBS) and Collateralized Debt Obligations (CDO). Between 2007 and 2009, the total losses in China's financial system were limited to just over 2% of China's precrisis GDP [14].

6. China's Major Challenges

While China's success has been remarkable, its economy still faces a number of major challenges.

6.1. Rebalancing the Economy. Despite the enormous success, China's export led growth is not a viable long-run strategy. There is a great deal of consensus including within the Chinese government that a substantial rebalance of the economy is needed. Domestic consumption remains an extremely low proportion of the economy, while dependence on exports is too high. In 2007, for example, earnings from exports accounted for 37% of China's GDP.

Likewise, serious questions have been raised about the efficiency of the extremely high levels of investment. Such rebalancing will not only provide a more sustainable domestic growth strategy but will also help with reducing global economic imbalances and reduce the threat that importing countries will take protectionist measures against China's exports.

While there is broad agreement on the objectives of rebalancing, progress has been low and faces considerable obstacles. Reducing overinvestment may face substantial political opposition from those who have been gaining from their investment. Increasing domestic consumption relative to saving is also difficult since it will require a substantial expansion of the social safety net in order to reduce the incentive for precautionary savings.

While most economists believe that substantial appreciation of the RMB would help rebalancing as well as reducing inflationary pressures, the short-run dislocations that this would cause also generates political opposition [17].

6.2. Inflationary Pressures and Price Bubbles in the Real Estate Sector. While the Chinese stimulus program was quite successful in reducing the size of the slowdown in economic growth, it carried adverse side effects in terms of increasing inflation and contributing to what many see as a real estate bubble.

While the aim of the stimulus program was to increase consumption and business investment, a substantial proportion of the resulting credit expansion flowed into the stock and real estate markets. Inflation quickly became one of the major challenges in China. Especially sharp price bubbles appeared in the real estate sector. For example, by unofficial estimates, the average price of an apartment in Beijing has

risen between five to ten times in the past decade. Thus, China is at risk of a bursting asset price bubble, which would damage its banking sector and credit system even more severely than the 2008-2009 crash [18].

The increases in the general price indices also started to rise soon after the stimulus package was implemented, thus showing signs of a short-run Philips curve where rapid expansions of aggregate demand tend to increase both economic growth and inflation. Since mid-2009, the CPI in China has been increasing overall, reaching around 5.5% in October 2011 which is higher than the average inflation rate of 4.25% from 1994 until 2010. These inflationary concerns in turn stimulated the most recent tightening of monetary policy.

6.3. Nonperforming Bank Loans. Nonperforming bank loans have been a problem for some time, and the rapid expansion of credit during the stimulus program has brought this problem to the fore again.

With China central government debt being so low (about 20% of GDP) and foreign reserves so high, the government has been able to afford to bail out banks. China has recapitalized banks several times after periods of economic stress and to prepare them for WTO entry and eventual foreign competition. In 1998, China issued \$33 billion worth of special government bonds to recapitalize the four major state-owned banks (Agricultural Bank of China, Bank of China, China Construction Bank, and the Industrial and Commercial Bank of China) which were otherwise technically insolvent. In 1999, China created four asset management companies that bought \$170 billion of bad loans from these four biggest state-owned banks at face value. Further capital infusions were undertaken in advance of the 2005-2006 initial public offerings (IPOs) of Bank of China, China Construction Bank, and the Industrial and Commercial Bank of China, while a further \$US 19 billion capital injection in November 2008 helped pave the way for Agricultural Bank of China's belated July 2010 IPO [19]. Recently, the government again recapitalized the state-owned banks with an estimated \$56 billion in 2010. As most of the Chinese banks remain dominated by the government, banks will not refuse to offer new loans if the authorities demand that they do so, even as old loans sour. New lending by banks was equivalent to 31% and 21% of GDP in 2009 and 2010, respectively, and 39% and 34% of GDP if off-balance-sheet lending is factored in. Over just the first eight months of 2011, Chinese banks reported about \$60 billion in new nonperforming loans. Among 14 large commercial banks, more than half reported an increase in nonperforming loans (NPL) in excess of 10% since June 2010 [20] and private estimates are usually much higher than official ones.

By March 2011, China's credit-to-GDP ratio had already risen to 166% as compared to 120% at the end of 2008 [21]. As Credit Suisse Group AG suggested when it announced that it was cutting Chinese bank's rating in June 2011, China's credit "has risen to alarming levels in the past two years due to massive off-balance-sheet financing, and raised a red flag for future asset quality problems in banks" [22].

6.4. Other Problems. Of course, China faces a number of other economic problems as well. While the global crisis has clearly illustrated the importance of having adequate levels of international reserves, China has accumulated far more reserves than are needed for this purpose. These excess reserves are an inefficient use of scarce national resources. There reserve holdings are also more heavily concentrated in dollars than is desirable on grounds of portfolio diversification. Dealing with these issues will not be easy as reducing the level of reserves would require substantial adjustments in the balance of payments and rapid reserve diversification would run the risk of generating a dollar crisis.

Other concerns are how to combine continued rapid economic growth while taking actions to deal with a wide range of environmental issues. Similarly ways must be found to continue to promote growth without continuing large increases in income inequality among both individuals and regions.

How best to continue financial reforms is another difficult issue. The global crisis has painfully illustrated the dangers of inadequate supervision of the financial sector, but the current financial systems in China create a number of serious distortions. Thus, further financial liberalization needs to be pursued, but in a very careful manner.

7. Concluding Remarks

A major theme of our paper is that the argument that China's growing economic strength has led to a decoupling from developments in the advanced economies is greatly overstated. China is having an increasingly large impact on the global economy, but economic interdependence runs strongly in both directions.

A second theme has been that, despite its heavy export dependence, China was able to take forceful policy actions to reduce the negative effects of the global recession.

We have also argued that, despite the huge economic strides that China has made, it faces a number of enormous economic challenges to rebalance its economy for sustainable economic growth and playing an increased role in promoting international and regional economic and financial cooperation.

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Research Article

Bank Lending, Inflation, and China's Stock Market (2004–2010)

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The 2009 surge in bank lending in China was accompanied by allegations of substantial funds being funneled into the nation's stock and property markets. This paper uses 2004–2010 People's Bank survey data to examine the possible linkages between banking activity and the stock market as well as the associated inflation risks. In general, stock market strength in China seems to be accompanied by rising inflationary concerns, increased bank lending activity, and reduced banker confidence that stable conditions will be maintained. This suggests that the Shanghai market could serve as a useful indicator variable for Chinese monetary policy.

1. Introduction

The bad loan problems of China's large state-owned commercial banks (SOCBs) have been well documented, as have the successive capital infusions and balance sheet cleanups that allowed Bank of China (BOC), Bank of Communications (BOCOM), China Construction Bank (CCB), and Industrial and Commercial Bank of China (ICBC) to go public in 2005–2006, followed by Agricultural Bank of China (ABC) in 2010. Reports of rising bank profitability have been accompanied by allegations that substantial amounts of the funds lent were being used not in financing real economic activity but in speculation in the nation's stock and property markets, however. Such claims came to a head in 2009 with a surge in bank lending prompted by Chinese government efforts to support the economy during the global financial crisis. Bank loan issuance in the first half of 2009 alone totaled RMB 7.37 trillion, exceeding the full-year total from 2008. This was accompanied by a 60% rise in the Shanghai stock market over the first six months of 2009, with many observers pointing to large sums being “diverted into shares and property” [1]. Wei Jianing, Deputy Minister of State Council Research Center's macroeconomics department, estimated that about 20% of total bank credit flowed into the stock market in the early months of 2009.¹ Many business owners simply transferred funds borrowed

under the government's easy money policy to an account with another bank, from which they could enter the stock market away from the scrutiny of the original lender.²

Full-year lending in 2009 totaled RMB 9.6 trillion, representing nearly half of that year's GDP. Although the China Banking Regulatory Commission (CBRC) released reports from some regions that two to three percent of funds were misappropriated [2], there are, of course, no official time series documenting just how much money was actually illegally channeled into the stock market. There are, however, survey data collected by People's Bank of China that, while not allowing us to determine the exact sums involved, offer an interesting window into the possible link between bank lending and China's stock market. We also utilize People's Bank survey data on inflation expectations to consider the perceived inflation risk that might be associated with intensified banking activity and stock market gains. Our empirical work identifies causal relationships between the stock market and the survey-based banking series as well as with inflation expectations. The linkages between bank lending, the stock market and overheating concerns are in line with the inflationary risks attributed to asset price booms elsewhere in East Asia by M.S. Gochoco-Bautista [3]. Although the question of whether monetary policy should react to asset prices remains highly controversial, medium-term inflation targeting implies that the central bank should react to booms that are

“expected to produce overheating in the near future” [4]. Such expectations certainly seem to be prevalent in the 2004–2010 Chinese experience assessed below.

2. Banker Sentiment, Inflation Expectations, and the Shanghai Stock Market

Beginning in the first quarter of 2004, the People’s Bank of China has reported quarterly survey data based on a sample of 2900 different banking institutions (including rural cooperatives). The survey is answered by those in charge at the bank’s headquarters, presidents of first and second-rank branches or vice presidents who are in charge of loans and credits. The survey results reflect quarter-to-quarter comparisons for the following two measures.

(i) The Banking Business Index (after first excluding any institutions providing a “not sure” response) calculates the proportion (c_i) of banker responses on the level of their business within five weighted (q_i) categories ranging from “Very Good” = 1, “Good” = 0.75, “OK” = 0.5, “Bad” = 0.25, to “Very Bad” = 0. The resulting formula is given by $I = \sum_{i=1}^5 c_i q_i$. Each category must lie between 0–100%, in percentage terms, and index values above 50% suggest expansion and index values below 50% indicate contraction.

(ii) The Index of Bankers’ Confidence is the arithmetic average of the proportion of bankers who believe this quarter’s economy is normal and the proportion of bankers who expect conditions to be normal going forward.³

The banking survey data offer a perspective from top-level officials across a very wide range of China’s banking institutions. The two series also have the advantage of reflecting sentiment on current conditions whereas standard bank performance measures continue to be heavily influenced by historical factors and preexisting conditions. For example, the SOCBs had longstanding bad loans to loss-making state-owned enterprises (SOEs), while successive government recapitalizations affected not only the large SOCBs but also the city commercial banks and other institutions.⁴ Although the sample period for the sentiment series is limited, the 2004 start date precedes the IPOs of four of the five large SOCBs in 2005–2006 and also encompasses a number of sharp swings in China’s economy. Surging economic growth and growing capital inflows led to repeated concerns with the rate of credit expansion from 2003 to 2007 that spurred a series of tightening measures by the People’s Bank and government pressure on commercial banks to rein in lending (see, e.g., [5, chapter 4]). This was followed by a shift toward concerns of slowdown and even deflation as the global financial crisis hit home in 2008, prompting a large government stimulus program (equivalent to \$US 600 billion or 20% of China’s GDP) supported by demands for more rapid loan growth by the banking system. The pendulum swung back again as renewed concerns about overheating and excess lending reemerged by the middle of 2009, seemingly justifying the monetary tightening undertaken in response [6].⁵

Stock market sensitivity to such policy swings would be in line with Sun et al. [7] finding that a significant asset price channel has operated alongside bank lending and interest

rate channels in China’s monetary transmission mechanism during 1996–2006, seemingly pointing to the importance of wealth effects.⁶ Over our 2004–2010 sample period, 2006 marks the first big rise in the Shanghai A-share index, when the market more than doubled before rising by a further 96% in 2007.⁷ The Shanghai A-share index subsequently declined dramatically in 2008, more so than most other world markets. In falling below 2000 in October 2008, the market registered a more than 75% drop relative to its peak above 6000 in October 2007. The market rebounded sharply in 2009, however, as lending rates accelerated dramatically following the launch of the government’s stimulus package in November 2008. In addition to the stock market boost stemming from the overall relaxation of credit constraints, the Shanghai Stock Exchange stood to especially benefit from any increase in investor demand for bank shares, given their pivotal role in the index. Indeed, over the June 1, 2006 to November 15, 2007 period, Yao et al.’s [8] causality testing supports a unidirectional causal relationship between most bank stock prices and the Shanghai Composite Index—including CCB and ICBC, which in 2006 became the largest two banks in the world by market capitalization.⁸

Our analysis examines the relationship between the two bank survey measures and the stock market during 2004–2010 while also incorporating People’s Bank survey data on “Current Price Satisfaction” and “Future Price Expectation” to take into account inflation concerns. Both of these latter series are based on approximately 20,000 questionnaires returned from 50 large-, medium-, and small-sized cities across the country. The Current Price Satisfaction index simply reflects people’s stated level of satisfaction with current prices. The higher the index, the greater the satisfaction—and the less those surveyed appear to be worrying about inflation. Meanwhile, higher values of Future Price Expectation imply increasing concerns about future inflation. Thus, insofar as higher bank lending rates lead to concerns about overheating, we would expect a rising Banking Business Index to be accompanied by falling Current Price Satisfaction and rising Future Price Expectation. In the analysis below, we examine the empirical support for this proposition in addition to testing for causal relationships between the banking measures and stock market performance. We utilize the complete set of available survey data from the first quarter of 2004 through the last quarter of 2010.⁹

3. Data Analysis and Causality Testing Results

The sharp ups and downs in the stock market over our 2004–2010 period, along with the accompanying movements in the Banking Business Index, can be seen in Figure 1. The stock market values reflect the end-of-quarter close of the Shanghai A-share index.¹⁰ The apparent comovement of the two series is also reflected in a high correlation coefficient of 0.724 (Table 1). The Banking Business Index and Shanghai A index each have negative correlations with Current Price Satisfaction (–0.495 and –0.588, resp.) and positive correlations with Future Price Expectation (0.827 and 0.577, resp.). Insofar as banking business and share values tend to rise together, this could well reflect higher demands for

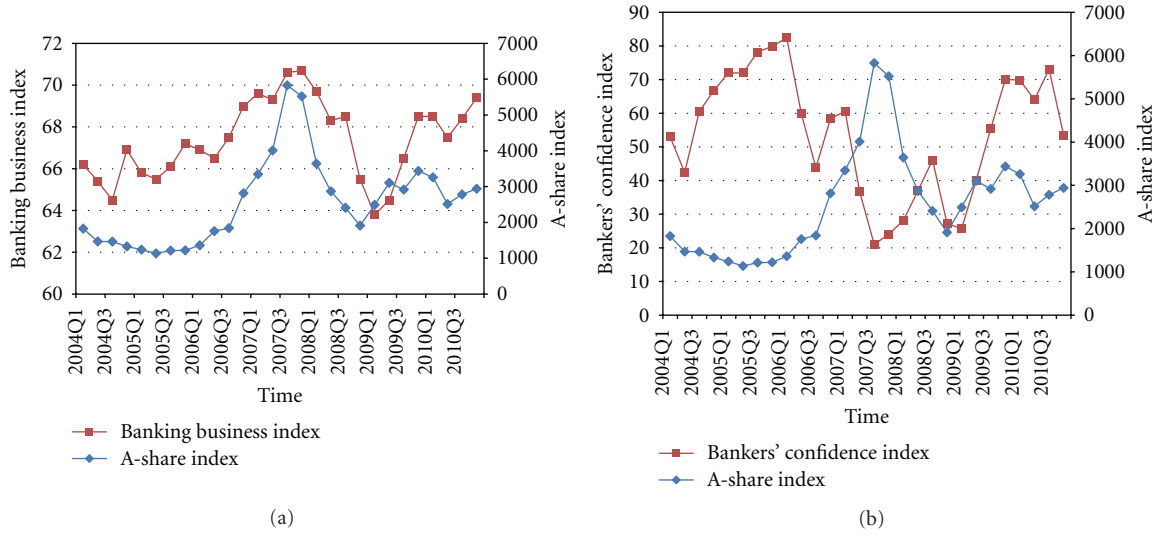


FIGURE 1: The two banking measures and the Shanghai A-share index, 2004–2010.

TABLE 1: Simple Correlation Coefficients Between the Shanghai Market, the Banking Measures, and Inflation Expectations.

	Banking Business Index	Bankers' Confidence	Current Price Satisfaction	Future Price Expectation	Shanghai A-Share Index
Banking Business Index	1				
Bankers' Confidence	−0.185	1			
Current Price Satisfaction	−0.495	0.233	1		
Future Price Expectation	0.827	−0.087	−0.505	1	
Shanghai A-Share Index	0.724	−0.597	−0.588	0.577	1

Note: All variables are in levels.

bank loans when asset prices are on the rise and concomitant overheating concerns are present in the economy. Meanwhile, Bankers' Confidence is negatively correlated with the Shanghai A index (−0.597) and has a smaller positive correlation with Current Price Satisfaction (0.233) and negative correlation with Future Price Expectation (−0.087).

The tendency for Bankers' Confidence to move inversely with the stock market, in contrast to the Banking Business Index, can be seen in Figures 1 and 2. It seems that bankers are less prone to believe in normal, or steady, conditions at times when the stock market is rising. Meanwhile, Figure 3 offers further support for positive co-movement between the Banking Business Index and Future Price Expectation. In line with the relatively small correlation coefficients seen earlier, there is little clear-cut comovement between Bankers' Confidence and the price measures, however. Finally, Figure 4 offers visual confirmation of a negative relationship between the stock market and Current Price Satisfaction and a positive relationship with Future Price Expectation. An overall tendency for the Banking Business Index, the stock market and Future Price Expectation to move together is consistently indicated by the correlations and plots. Meanwhile, Bankers' Confidence seems to move inversely to the stock market but is not so clearly linked to the price series.

In order for formally test the significance of the relationships between the variables in question, we conduct a series of Granger-causality tests. The data are converted into log growth rates owing to unit roots in levels, with all series being stationary after conversion to growth rate form.¹¹ Causality test results are based on Wald test statistics generated from vector autoregressions (VARs) for each pair of variables under a lag length of one for the quarterly data.¹² The general form of the bivariate VARs is as follows:

$$\begin{aligned}
 \Delta \ln(\text{Share})_t &= \alpha_1 + \beta \Delta \ln(\text{Share})_{t-1} + \delta \Delta \ln(\text{Banking})_{t-1} + \varepsilon_{1t}, \\
 \Delta \ln(\text{Banking})_t &= \alpha_2 + \gamma \Delta \ln(\text{Banking})_{t-1} + \varphi \Delta \ln(\text{Share})_{t-1} + \varepsilon_{2t}.
 \end{aligned} \quad (1)$$

Summary statistics on each data series are presented in Table 2 and the Granger-causality test results follow in Table 3. These results suggest that there is unidirectional causality running from the Shanghai A index to the Banking Business Index (at the 98% confidence level) and from Bankers' Confidence to the Shanghai A index (at the 98% confidence level). Our finding that rising stock values give rise to increased banking activity, but not the reverse,

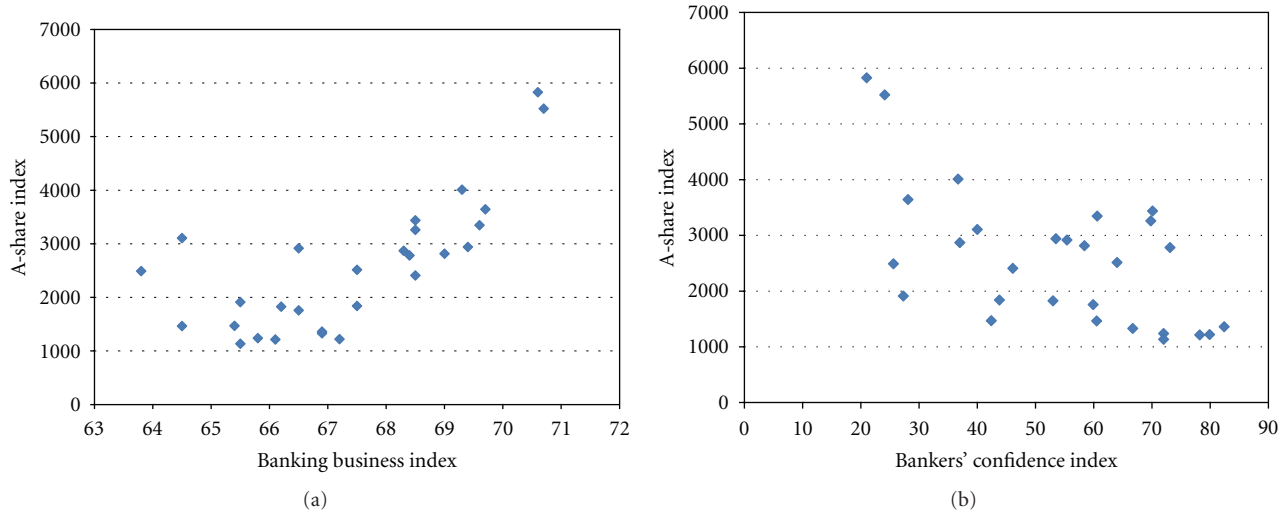


FIGURE 2: The Shanghai A-share index plotted against the two banking measures.

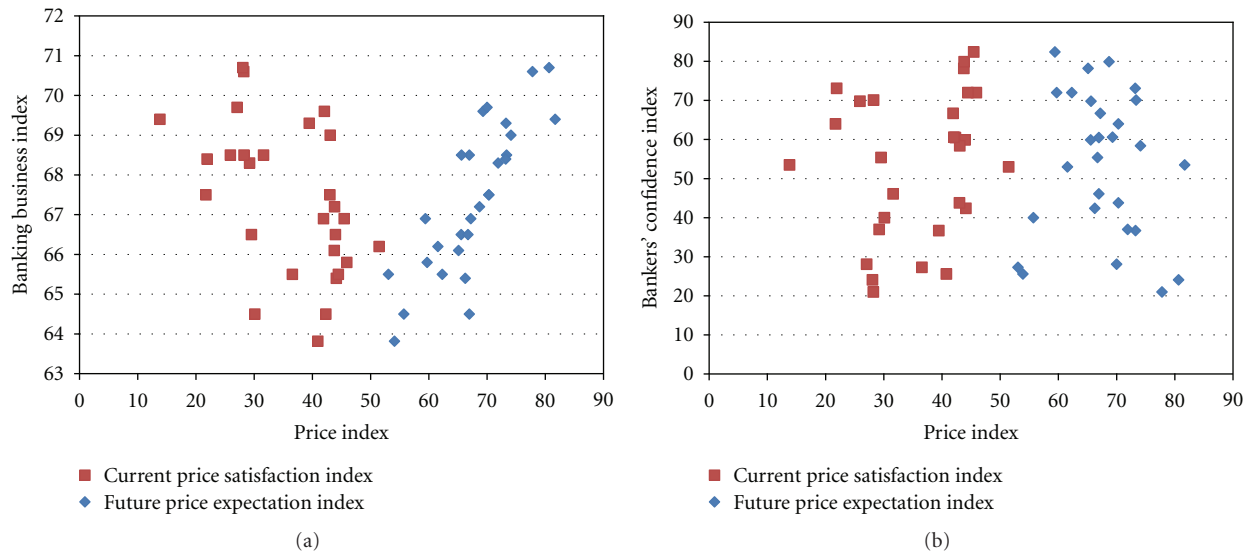


FIGURE 3: The two banking measures against current price satisfaction and future price expectation.

would support the premise that higher bank lending is itself driven by more buoyant market conditions—as opposed to being the actual cause of a surging market. Meanwhile, the suggested (negative) causal effect of Bankers' Confidence on the Shanghai A market implies that more widespread belief in normal or stable conditions is negative for the market—which would indeed generally be expected to benefit from more exuberant expectations.

Although there are no significant causal relationships between Current Price Satisfaction and the Banking Business Index, Future Price Expectation has a positive causal effect on the Banking Business Index that is significant at the 99% confidence level. The direction of this effect is consistent with the signs of the simple correlation coefficients laid out in Table 1. Higher Shanghai A index levels were themselves

seen to be strongly positively correlated with Future Price Expectation (and also negatively correlated with Current Price Satisfaction) in Table 1. The relationships with the Banking Business Index appear to be strictly a one-way street, however, with banking business seemingly receiving a boost when share prices and inflation expectations are on the rise but having no detectable causal role in fueling such developments. Although it is not obvious that banking business would be boosted by inflation *per se*, higher demands for bank loans could be explained by the surging asset prices that accompany these overheating concerns as borrowers seek to take advantage of the more buoyant market conditions. Meanwhile, significant (negative) one-way causality running from the Shanghai A index to Current Price Satisfaction suggests that stock market booms may add to inflation

TABLE 2: Summary statistics for the Shanghai index and survey data.

(a) All variables in levels					
Variables	Number of observations	Mean	Standard deviation	Minimum	Maximum
Banking Business Index	28	67.39	1.88	63.80	70.70
Bankers' Confidence	28	53.63	18.50	21.00	82.40
Current Price Satisfaction	28	35.97	9.42	13.80	51.45
Future Price Expectation	28	67.52	7.22	53.05	81.70
Shanghai A-Share Index	28	2559.36	1220.96	1135.12	5827.66
(b) All variables converted to log growth rates					
Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
Banking Business Index	27	0.002	0.019	-0.045	0.037
Bankers' Confidence	27	0.0003	0.276	-0.558	0.446
Current Price Satisfaction	27	-0.049	0.136	-0.462	0.146
Future Price Expectation	27	0.010	0.094	-0.233	0.181
Shanghai A-Share Index	27	0.018	0.204	-0.416	0.425

TABLE 3: Causal relationships between the banking measures, inflation expectations, and the Shanghai A-index.

Causal Relationship	Coefficient Sum	Chi-Squared Statistic	Number of Lags	Confidence Level
Banking Business → Shanghai A	-0.023	0.937	1	66%
Shanghai A → Banking Business	0.041	5.387	1	98%
Bankers' Confidence → Shanghai A	-0.311	6.516	1	98%
Shanghai A → Bankers' Confidence	-0.230	0.814	1	63%
Current Price Satisfaction → Banking Business	-0.050	2.214	1	86%
Banking Business → Current Price Satisfaction	-0.239	0.026	1	13%
Future Price Expectation → Banking Business	0.149	16.815	1	99%
Banking Business → Future Price Expectation	-1.104	0.951	1	67%
Current Price Satisfaction → Banker's Confidence	-0.644	1.880	1	83%
Banker's Confidence → Current Price Satisfaction	0.060	0.375	1	45%
Future Price Expectation → Banker's Confidence	0.740	1.761	1	81%
Banker's Confidence → Future Price Expectation	-0.062	0.846	1	64%
Current Price Satisfaction → Shanghai A	0.424	1.593	1	79%
Shanghai A → Current Price Satisfaction	-0.299	6.127	1	98%
Future Price Expectation → Shanghai A	0.000	0.000	1	0%
Shanghai A → Future Price Expectation	0.117	1.588	1	79%

Note: The above statistics reflect Wald tests for Granger-causality based upon VARs estimated with one lag on each variable (all of which are in log growth rate form); relationships significant at the 90% confidence level or higher are depicted in bold print.

concerns but are not driven by them. Finally, there is no evidence of any significant causal relationships between the price series and Bankers' Confidence.

4. Conclusions

People's Bank survey data on banking activity, and inflation expectations support a causal relationship between inflation expectations, banking activity and the stock market during 2004–2010. The results imply that fears of inflation amidst surging bank lending and share prices are not just a figment of the 2009 experience but hold also over the sample period as a whole. While there is evidence of direct causal relationships between banking activity, inflationary

pressures, and the stock market, the banking indicator seems to be driven by stock market moves and concomitant inflation concerns, rather than being the actual cause of any overheating that takes place. This leaves open the question of whether heightened bank lending is more a symptom than a cause of inflationary pressures in the economy, with the stock market seemingly moving before the banks. Finally, there is some support for a negative relationship between banker confidence and stock market strength. In general, stock market strength in China seems to be accompanied by rising inflationary concerns, increased bank lending activity, and reduced banker confidence that stable conditions will be maintained. This would seem to offer at least some justification for the People's Bank continuing to pay attention

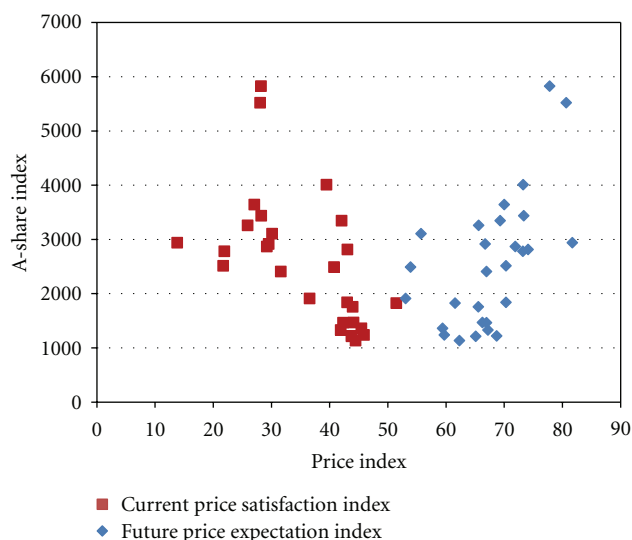


FIGURE 4: The Shanghai A-share index plotted against current price satisfaction and future price expectation.

to the stock market in determining its monetary policy stance and suggests that the Shanghai index might actually serve as a useful indicator variable in China.¹³

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Endnotes

1. See “Expert warns more than RMB 1 trillion in new loans made their way to the stock market” (2009), July 6 [http://www.stnn.cc/chinafin/200907/t20090706_1058324_2.html] (in Chinese).
2. One reporter found that 28 of 30 business owners surveyed were engaging in such practices in mid-2009, typically taking out the loans solely because of the opportunity to play the market with the proceeds [9].
3. While no precise definition of “normal” is provided in the People’s Bank survey materials, it implies a belief in stable operating conditions. Regular commentary on the two series is provided, in Chinese, in the “survey and statistics” section of the People’s Bank website (<http://test.pbc.gov.cn/publish/diaochatongjisi/193/index.html>).
4. For analysis of recent trends in Chinese bank balance sheets, and the relative position of the SOCBs, see, e.g., Lu et al. [10], Yao et al. [11], Cheng [12], Jia [13], Matthews et al. [14], Jiang and Yao [15], Luo and Yao

[16], Matthews and Zhang [17], and Burdekin and Tao [18].

5. As part of the efforts to bring bank lending rates back down, the CBRC acted to close a loophole that had allowed China’s banks to move loans off their balance sheet by repackaging them as “trust products” [19].
6. Although the property market may also be sensitive to bank lending rates [20], real estate policy such as land supply plays a key role and has almost certainly distorted the relationship between house prices and economic fundamentals in China [21].
7. The A-share market for local investors is far more liquid than the separate B-share market for foreign investors and is the bellwether stock index for mainland China. For more details on the evolution of China’s financial markets, and the different share classes, see, for example, Wong [22], Chan et al. [23], and Burdekin ([5], chapter 8). Rising market sentiment helped trigger a drawdown of savings accounts as local investors were increasingly drawn to the stock market [24, 25].
8. CCB and ICBC retained their top positions through the end of the year 2010 with BOC and ABC following in sixth and eighth place, respectively.
9. The banking survey series were subsequently reconfigured at the beginning of 2011.
10. The stock exchange data are drawn from the Global Financial database (<http://www.globalfinancialdata.com/>) and all other data are available from the People’s Bank of China website (<http://www.pbc.gov.cn/>).
11. As an alternative to the end-of-quarter values for the Shanghai A index we considered quarterly averages. This had very little impact on the findings and led to no change in our inferences, but had the drawback of remaining nonstationary even after being converted into log growth rate form.
12. Although limited by the length of the available quarterly dataset, this parsimonious specification at least allows us to maintain 22 degrees of freedom for the causality testing. Allowing for longer lag lengths up to a maximum of four produced only two instances where the AIC criterion selected a lag length greater than one. The only effect such longer lag lengths had on the inferences was a suggested additional causal effect running from Current Price Satisfaction to the Shanghai A index under a lag length of four. We put less stock in this result as experimentation showed it to emerge only under this specific lag order and also because of the highly limited degrees of freedom when four lags are included in the VAR.
13. Zhao and Gao [26] advocate an even more widespread adoption of this approach encompassing housing prices as well as share prices.

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Review Article

The People's or the World's: RMB Internationalisation in Longer Historic Perspective

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Prognoses of China's currency—*Renminbi* or RMB in short—going global have become a hotly debated topic in the economic and popular literature of late. While some analysts are tipping a gradual transformation of the RMB into the world's next principal reserve currency in lieu of the US\$, others contend that the deficiencies of China's financial market will continue to preclude any such transformation for a long time to come. The aim of this paper is to survey the arguments put forward by either camp and to weigh into this debate not only through the prism of applied economic theory or political economy but also through the prism of economic history.

1. Introduction

The need to approach the issue of RMB internationalisation from fresh perspectives may perhaps be partly vindicated by what Wu et al. identify as the inevitable “paucity” of empirical analyses [1]. Equally compelling, however, is the fact that much of what has already been written on this issue is predicated on the fairly recent historic experience of the onset of the pound sterling and US\$ through the 20th century, and on the still more recent experience of the Euro in the early 21st century. (See, e.g., Hefeker and Nabor [2].) Implicitly, therefore, the prospects of RMB internationalisation are assessed based on indicators of convergence between the Chinese economy at present, and the British, American, Japanese, or EU economies in recent decades. But such an analytical framework, when removed from the broader historic context, might of itself rule out a more distinct Chinese path to global economic eminence—one where, for example, the depth of domestic capital markets might not turn out to be a critical determinant of RMB internationalisation as was the case in the Anglo-American development trajectory.

The following historic survey can perhaps shed light on current debates about the future role of RMB in at least one way: they remind us that the prospect of Chinese currency used as international currency may not be entirely new. For

even though traditionally cast Chinese copper coinage was swept aside by Western steam-powered minting technology in the late 19th century, it had for a millennium or so prior set the benchmark for East and Southeast Asian monetization. As China was phasing out traditional copper coinage—known as *caixa* or “cash” to Europeans—Chinese indentured labourers were still taking it with them aboard British ships sailing across the South Pacific to serve as token currency for gambling and grocery purposes [3].

The analysis offered below explores what might inspire a geopolitical rally around, and popular trust in, the RMB as alternative reserve currency in the near future. It aims to revisit the degree to which the well-known and widely discussed imperfections of China's domestic capital markets could hinder currency internationalisation. Reliable currency is conventionally understood here as primarily a “store of value,” “unit of account” and “medium of exchange” (for a classical theoretical discussion, see, e.g., Von Mises [4]).

In this context, economists such as Wu, Pan, and Wang seem to suggest that “highly developed and open capital markets in the home economy, where foreign investors can freely trade the currency-denominated financial instruments and generate profit,” is *one of eight* important requisites that an “aspirant” international reserve currency must satisfy [1]. The other five important requisites to consider would be

China's perceived geo-political clout, its credit-worthiness, and the relative size of its economy; the ability of foreigners to obtain and convert RMB notes on demand; low domestic inflation and low exchange rate volatility; lack of administrative or legal barriers to RMB cross-border mobility. Yet, because they accord great significance to the depth of capital markets—precisely as the Anglo-American experience would warrant—Wu, Pan, and Wang conclude that “[i]t is probably too optimistic...to expect the RMB to become a global currency *before 2025*” [1].

2. The Historicity of Chinese Currency as Global Currency

Economic historians might, on their part, *not* wish to exclusively ponder “China's rise” as a 21st-century strategic actuality, and also draw insights from China's preponderance in the premodern global economy going as far back as antiquity. Notably, whilst hybrid Sino-Hellenistic copper coins from the CE 1st century were excavated in Xinjiang, no pre-modern Chinese (or Indian) coins were ever found in Western Europe. Similarly, many Sassanid-Iranian (CE 224–651) and some contemporaneous Byzantine gold coins were found much further east near Huhehot in Inner Mongolia as well as in Northwest China, but only few Chinese coins of that period were found west of the Tarim Basin. The Sassanids imported Chinese porcelain *en masse* and seemed to have paid these off with bullion; there is little evidence of significant backflow of Chinese coins to Iran before the Song era [5, 6]. Conversely, Roman coins of the Republican period were widely excavated in India but not in China proper, even though Chinese silk was a luxury commodity imported to Rome through the Silk Road [7–10] (small quantities of North Indian coins minted in the 9th–10th centuries were discovered in the USSR west of the Urals. See, [11]).

In light of these findings, it seems that scholars should strive to better demarcate the supply of various currencies and of currency substitution across pre-modern Eurasia. Suffice it to note here that, in excavations of Xiongnu tombs in present-day Mongolia, for example, golden jewelry from the West was found alongside Chinese silk and copper coins, but Hellenistic coinage of that era was nowhere to be seen. In sites as faraway east as the Feng Sufu Tombs (Beipiao, Liaoning) glassware of Roman origin was found dating back to 5th century CE, yet even in a site of that later era there was no evidence of Roman coinage [12].

It would appear that the great breakthrough of Chinese copper coinage beyond China proper occurred during the cosmopolitan Tang period (CE 618–907). At that period, Chinese coinage had served as a model for Japan's first indigenous currencies and was sought after for the first time in many parts of North and Southeast Asia where standardised media of exchange were scarcer. Subsequently, Chinese copper coinage of the Song dynasty (CE 960–1279) was even current in some parts of South India possibly through trade links with Southeast Asia. Song coinage had become so popular that it could serve as the currency of choice—either through import or local emulation—in many parts of Southeast

Asia. Such coinage thus supplanted by the 13th century CE Java's original currency system, which had been predicated as early as 8–9th centuries CE on South-Indian-inspired silver-gold weights [13]. Moreover, in the mid-12th century, Japan imported large amounts of Chinese copper coins, even though it was more abundant in copper than China, and certainly not bereft by then of coin production metallurgic knowhow [14].

Chinese pre-modern copper coinage reached the apex of its global presence around the 14th century by which time it had been circulating widely in Japan, Korea, Annam, and along the coastal trading hubs of Cambodia, Thailand, and Burma. It was also rapidly gaining popularity in Java and parts of Sumatra, the north Philippines, and Borneo at much the same time. To a lesser extent, Chinese coins could be found along India's Malabar and Coromandel coasts, and in Ceylon between the 7th–14th centuries [13, 15]. The earliest Chinese copper coins found in Sri Lanka appear to date back to the 9th century CE, whilst some of the Chinese coins found in South India date back to 7th century CE. The famous tributary missions, on which the Yongle Emperor sent eunuch Zheng He (CE 1371–1453), even brought Chinese copper coinage to Mainland East Africa, whilst on Zanzibar Chinese coins may have been first used as early as the 7th century CE [16, 17].

It was only in 1636 and 1678, respectively, that the Tokugawa shogunate in Japan, and Choson Korea, were able to fully supplant Chinese copper coins with their own copper coinage [18–20]. In fact, when the Dutch arrived in Southeast Asia in the 17th century, they found that Chinese copper coinage had been so popular there that they began importing copper coinage directly from China. Such coins were in high demand in, for example, less-monetized Annam, and sold there in return for Annamese raw silk. The Dutch then sold the silk in Japan in return for locally mined silver, which could fetch enormous profits when sold in China [13].

The Dutch attempted to introduce their own silver colonial coinage (*dubbeltjes*) in Java, but these did not take root. Therefore, until the 18th century, they relied on the local Chinese community for a supply of *picis*—the Javanese term for locally cast Chinese-style coinage. It was only in 1724 that the Dutch felt confident enough to reintroduce a European-style copper coin (*duiten* or *doits*). The production of *picis* was discontinued as late as 1763, by which time the main high-denomination regional currency was Spanish-American silver dollars (a.k.a peso, piece-of-eight, or Carolus dollar); Dutch gold stuiver coins never gained the upper hand locally [21].

3. The Origins of Monetary Globalization and Residual Divergence

The discovery of abundant silver deposits in Latin America (16th century) reconfigured the pre-modern Eurasian monetary system, ushering in the first thrust of globalization [22]. On the one hand, this newfound source of silver reinforced the West's comparative advantage in precious-metal supply, and, on the other hand—it made possible the creation of

a truly global currency (the Spanish-American silver dollar) for which the Chinese were willing to sell ever-greater quantities of tea and silk [23].

Latin-American silver discoveries dovetailed with Ming China's (CE 1368–1644) sharp reduction of mining and coin production, and its growing reliance on external supply of high-denomination currency in the form of silver [24–26]. To be sure, the Qing dynasty (1644–1912 CE) revitalised annual coin production almost to the same peak level recorded during the Song five centuries earlier. But China's monetary system had become acutely reliant on imported silver by then, either in coin or ingot form. Silver mainly served as merchants' higher-denomination currency and was by far the preferred means of tax payment, even though its purity and authenticity were assayed privately for the most part. For reasons that are still not entirely clear, neither the Ming nor Qing polities opted to enhance domestic silver mine production or introduce silver coinage, right until the late 19th century when European minting technology was universalised [23, 27].

Archaeological findings confirm that, at least since early modern times, specie (in dollar denominations) flowed from West to East in return for commodities such as silk and tea. At the same time, Chinese copper cash flowed from East to Southeast Asia in return for tropical produce. Economic historians, therefore, might provocatively observe that there is nothing entirely new in the way that modern China is furnishing the US with manufactured goods in return for US\$ derivatives, whilst pushing for its own currency zone in Asia (see below). Granted, the reasons behind the undervaluation of the RMB against Western currencies nowadays, which renders Chinese goods so attractive overseas, and the reasons why Western silver currencies were at a premium in early-modern China owe to entirely different sets of circumstances; more importantly, since the collapse of the Bretton Woods accords in the mid-1970s, the US\$ can no longer be counted as specie substitute. Yet there does seem to be some uncanny resonance between the early modern global monetary system and the contemporary one in that China's net trade surplus with the West is largely funded by US Treasury bonds, which are denominated in an international currency still called *dollar*.

It is otherwise still not entirely clear why base metals such as copper played a much more limited monetary role in premodern West Asia and Europe compared with East Asia. Perhaps the only exception to this pattern was Japan where, as of the 17th century, copper coinage was supplemented with gold and silver coinage on the back of vigorous domestic mining expansion [28]. In early Medieval Europe silver coinage was predominant of course, whilst in Byzantium and the Islamic world both gold and silver flans were used to strike coins. As coins were smelted and often transported from one contiguous currency zone to another, the premodern world was devoid of a truly global currency circulating across *all* zones until the advent of the Spanish-American dollars.

That no single currency circulated right across Eurasia until early modern times was not only a result of the preference for copper in the East or the relative abundance of silver in the West but also the path-dependent monetary structures

that obtained in either region. These structures determined, amongst other prescripts, the production technology used and the modes of coin supply regulation. Hence, Chinese pre-modern coins of various eras all evince minimalist inscriptions, whilst European coinage was largely minted or struck with elaborate imagery; in pre-modern Europe “free coinage” was commonly tolerated, whereas in China coinage and mining were strictly seen as state prerogative [29].

Echoing the “oriental despotism” paradigm prevailing in Europe around his time, Max Weber famously posited that the Chinese preference for base-metal coinage had been designed to allow emperors greater opportunity to extract seignorage than was possible in Europe [30]. More recently, however, economic historian Akinobu Kuroda has noted that, in fact, Chinese copper coinage had perforce lower intrinsic value per unit of production and thus afforded lower seignorage potential than was the case in Europe. Drawing on decades of meticulous comparative study of East Asian currencies, Kuroda's important insight might also explain why in comparative terms, European feudal lords and West Asian sultans debased the composition of their coinage in pursuit of greater seignorage revenue more often than could be tolerated in Chinese statecraft. There, the provision of copper coinage came to be seen, in the first instance, as a corollary of the Confucian imperial duty to “alleviate the needs of the people” (*bianmin*) rather than a means to generate imperial revenue [31, 32].

Whilst subsidiary copper coinage had been issued in Republican Rome, the metal subsequently played a minor role in Europe's disparate monetary systems and remained rarely coined in much of the medieval period. It was only in the 16th century that alloy coinage containing copper spread all over Europe as token currency (*billon*) but was almost from the outset subject to heavy debasement (on *billon*, see [33]). Notably, banknotes had been invented in China as early as the 11th century but came into use in Europe only in the 17th century. It is arguably this temporal divide which might help explain the different paths by which Chinese emperors and European overlords resorted to enhance seignorage. The Mongol Yuan dynast not only relied on banknote issuance, but also radically reduced coin production precisely because it was deemed unprofitable to the throne. By fiat, therefore, less coin was required in China per se, and so large quantities flowed over the course of the 14th century to Southeast Asia where such standardized media of exchange were at a premium. Additionally, high-denomination note issuance made silver ingots less sought after in China, arguably resulting in outflow of the metal to Europe via West Asia over the course of the 14th century [34].

In China, therefore, copper cash was less readily debased than European coinage, whilst banknotes—mostly denominated in strings of 1,000 coins—were ultimately issued without adequate metallic reserve; Chinese imperially issued banknotes lost favour among the populace by the 15th century precisely because they were overprinted in order to enhance state revenue [31]. Initially, Europe's experience with banknotes was uneven to say the least, but a sounder reserve policy eventually took root in England in the 19th century as part of the emergence of the early modern national debt

economy, so much so that, with the suspension of the gold standard in the 1930s, European banknotes were no longer fiduciary but wholly fiat (i.e., not partially convertible into bullion), a situation obtaining formally today in most countries of the world following the collapse of Bretton Woods.

Indeed, the 19th century was a time when money incrementally shed its universal metallic anchorage with the transition to territorial currencies bound to nation states and central banks' "legal tender." However, due to political instability and civil war, China was not to have an effective single "legal tender" until 1935. From the mid- nineteenth century to 1949, successive imperial Chinese governments, warlord regimes, and semi-official banks had issued various types of paper currency with an uneven record of success. In addition, private money shop scrip, remittance drafts, military wage coupons, product certificates, and later even underground Chinese Communist Party (CCP) paper currency were circulating in different parts of the country concurrently [35].

As China ventured into economic modernity in the early twentieth century, silver dollars, subsidiary coins, and banknotes gradually superseded its late-Imperial bimetallic standard. But, for the next three decades, the leaders of the newly established Republic were unable to enforce monetary unification on breakaway provinces. An ephemeral turnaround appeared in sight only in late 1935, when an invigorated KMT (Kuomintang or "Nationalist") administration took China's currency off the silver standard and proclaimed its first fiat currency in the modern era, the *fabi*. In the lead-up to the *fabi* reform, a large number of regional banks still operated outside of the central government's reach. More often than not, these banks had been amenable to warlords, who did not hesitate to milk the local civilian population through what economists call an "inflation tax." In other words, many regional banks serviced warlord debt with proceeds obtained from banknote disbursement. Still others strove to fend off the unification thrust of the KMT government by maintaining a stable regional currency and securing banknote convertibility to bullion [35].

The KMT government's intention to trim its large budget deficit helped muster support for the 1935 move off silver. A modest budget surplus, a higher degree of monetary integration and some improvement in productivity were achieved during 1936-1937. However, in the final analysis, unchecked military spending incurred by anti-Communist campaigns and the impending war with Japan did not leave the *fabi*, much chance of retaining its credibility. In 1948, an eleventh-hour attempt to nominally repeg China's Nationalist currency to gold failed, unleashing hyperinflation and irreversibly tainting the KMT's reputation in economic management [36]. Today's talk of RMB as future global currency should therefore be placed against the backdrop of China's acute monetary fragmentation in the century or so leading up to the proclamation of the RMB.

Evident throughout both the early modern and modern phases in the evolution of Chinese currency is that having any form of currency widely accepted is contingent upon the degree of popular trust in its "store-of-value" and "exchange-

medium" properties. Indeed, the pound sterling's supplanting by the US\$ around the mid-20th century and the reasons why the Renminbi is perceived at present as challenging the US\$ viability as global reserve currency may both owe to geopolitical shifts in confidence. And despite the absence of equally detailed records from the 11th century, circumstantial evidence would indicate that much of Southeast Asia had transitioned from Indian-style coinage to Chinese-style coinage at least in part because of a shift in confidence vis-à-vis Northern-Song China (CE 960-1127), which was engendered in turn by the latter's reputation as an exporter by-default of reliable currency and as a powerhouse of economic advancement at the time and by its expanding trade links in the region [37]. Yet, the stature of Chinese-government-cast coinage as international currency went into steep decline through the remaining late-imperial era, reaching a low-water mark of popular confidence in the Republican period. Precisely how the RMB managed to restore faith in Chinese-government-issued currency therefore needs to be closely examined in the next section.

4. The Evolution of RMB in the Era of Central Planning

In the summer of 1947, the People's Liberation Army (PLA) was consolidating its advance across North and Eastern China, bringing territorial integrity under Chinese Communist Party rule to many parts of the country. Soon afterwards, trade links between areas previously cut off by civil war were reestablished. But often the currencies used across contiguous areas remained discrete; exchange rates between local currencies proved volatile through the civil war, greatly hampering economic recovery. Carrying over from the late-Imperial and Republican eras, this monetary fragmentation impinged on the momentum gained by PLA ground forces and brought to the fore the need to urgently unify China's currency. From then on, monetary unification became one of the most potent propaganda messages drummed up by the Communists, who were well aware of the deep-seated popular disenchantment with KMT monetary reforms in the 1940s.

As the area under Communist control expanded, the CCP leadership therefore had to turn its mind to macro-economic planning. Later in 1947, it proposed to unify China's disparate currency systems and to work toward a centralised mechanism of banknote issuance. To that end, Dong Biwu was appointed Chairman of the Economic Bureau of North China and entrusted with promoting a new "people's" currency—the RMB. Thereafter, currency unification measures progressed incrementally with local cadres and Dong occasionally publishing official exchange rates between the RMB and currencies issued by erstwhile authorities. Concomitantly, Dong launched an extensive campaign to rally grass-root support for the RMB. These concerted efforts led to the establishment of the People's Bank of China (PBC) as a bank singularly in charge of money supply on behalf of the advancing Communist forces. Gradually, the note issue prerogatives enjoyed by foreign banks operating on Chinese

soil were rescinded, followed by a Communist crackdown on Chinese bank prerogatives, but disparate currencies issued by the Communist themselves in different parts of the country continued to circulate side by side for another year or so [38].

On December 1, 1948, the People's Bank of China was formally established in Shijiazhuang, Hebei Province, that is, well before the proclamation of the People's Republic of China itself. On the eve of its establishment, there had been a plethora of currencies circulating side by side in recently "liberated" areas, namely, areas taken over by the Communists from retreating Nationalist forces. The main Communist regional institutions: the Farmers' Bank of Northwest China; the Bank of Southern Hebei, the Bank of Beihai, Zhongzhou Farmers bank, and the Bank of the Northeast. Over the course of 1949 most of these banknotes had been redeemed in return for new RMB notes at a rate of between 100 and 2000 units of older currency to 1 RMB [39].

At the same time, the PBC also enforced measures to strictly regulate China's privately run financial institutions, and constrain foreign bank's ability to transact local business. Most KMT-controlled semi-official banks were dissolved, as was the KMT central bank. Nonetheless, the two largest of these banks were merely reorganised, and their prewar name remains in effect up to the present: the Bank of China and the Bank of Communications. Smaller privately-run banks and family-run "money shops" (*qianzhuang*) were similarly reorganised under CCP oversight or dissolved [40].

These measures were all carried out with a view toward nominating the PBC as an all-powerful monobank within a few years. To that end, the PBC was allowed to go beyond traditional central bank roles and provide credit to retail and corporate clients, who were not suspected of KMT sympathies and formed China's shrinking and anxious private sector. Indeed, many such individuals and corporations were experiencing liquidity problems as the economy was gradually transitioning to central planning and collective ownership [41–44].

As China emerged from the great destruction of the civil war with a newly proclaimed national currency, severe inflationary pressures came to bear on the real value of the RMB in the early 1950s. These problems were allegedly compounded by the nominally high units of value of non-CCP currencies still unofficially circulating in some regions, by large quantities of forged notes disseminated by Japanese and later KMT special forces, and by intermittent food shortages (on Japanese forgeries, see, e.g., [45]; on alleged KMT forgeries, see, e.g., [46]). To make matters worse, the official exchange rate between RMB and older currencies often proved confusing because of the different denominations used and due to the low quality of RMB note printing as compared with some of the older currencies, which had been more resistant to wear and tear (on the evolution of RMB units, see PBC official data at: http://www.pbc.gov.cn/publish/huobijinyinju/387/1590/15901_.html).

In light of these problems, the CCP decided to embark on a second currency unification campaign. As of March 1955, the PBC exerted greater efforts to curb money supply

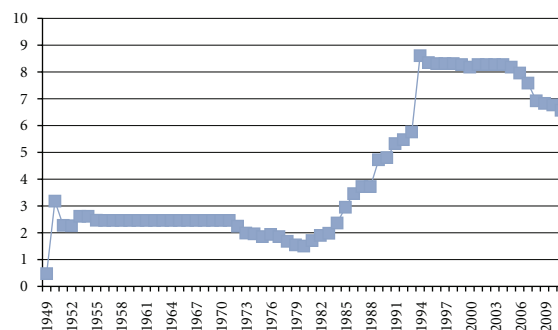


FIGURE 1: US\$ to RMB official exchange rate, 1949–2010.

and improve RMB note quality, whereby older RMB notes were converted to new ones at a rate of 1:10,000. From 1955 to the present, newly redenominated RMB remained legal tender. Concomitantly, the PRC set up in the mid-1950s highly centralised monetary oversight mechanisms. By the late 1950s, all banks had been merged into the PBC producing a monobank financial system. Under this system, the PBC wielded not only central bank administrative powers but also commercial banking functions; through cash-flow audits, tight credit overhaul and fiscal restraint on the part of the government, the PBC was eventually able to achieve price and money-supply stability and vest all monetary powers firmly in the hands of the state [43, 44].

RMB nominal foreign exchange rates during China's monobank era point to two primary development phases before the country opened up to foreign investment: 1955–1972 and 1973–1979. The first phase parallels the Bretton Woods accords, whereby Western currencies had been pegged to the US\$ at a fixed rate. During those earlier phases the RMB, too, was convertible into US\$ at a fixed rate of 2.46 to US\$ 1 (see Figure 1). In practice, however, the RMB was not tradable at all; its availability overseas was dictated by state-controlled trade without any correlation with market demand. During the later phase of 1973–1979, the Bretton Woods system collapsed, and Western countries successively went on a floating exchange rate; the PRC therefore decided to notionally adjust the RMB exchange rate based on the value of a basket of currencies, while at the same time aiming to maintain continuity by occasionally *revaluing* the RMB [47].

5. The Makeover of RMB in the Reform Era

With Mao Zedong's death in 1976, the CCP slowly moved to relax central planning. In 1979, Deng Xiaoping prevailed over Maoist hard liners to embark on a bolder set of economic reforms that came to be known as the Open-Door Policy (*gaige kaifang*). The reforms started off by allowing greater freedom to peasant household to retain surpluses above the production quotas set by the state and to semi-collectively operate township and village enterprises (TVEs). But the focus of policy makers quickly shifted to urban industries, where foreign direct investment in special economic zones was promoted. In the latter part of

1979, the PBC, too, embarked on monetary reform, whereby retail credit and deposit functions were localised, and the monobank system relaxed. By 1983 China's State Council declared formally that the PBC was to eventually assume only central bank responsibilities and withdraw from mercantile banking activity (the wording of this 1983 declaration as published in the CCP organ, the People's Daily (*Renmin ribao*) can be viewed at: <http://www.people.com.cn/item/flfgk/gwyfg/1983/112203198306.html>).

As a result, the PBC relinquished control of many branches across the country to focus on exercising monetary coordination in pursuit of macroeconomic growth objectives. In order to bolster export manufacturing, in 1981 the RMB was at first devalued in state-controlled foreign trade transactions vis-à-vis the official exchange rate. But, in other transactions such as remittances from overseas Chinese to family members on the Mainland, the basket-of-currencies peg was still applied. This two-tier approach accentuated China's cheap-labour advantages, while ensuring other contact between PRC and foreign nationals remained on an even keel (i.e., RMB purchasing power in terms of other currencies was not eroded across the board).

To be sure, this two-tier approach remained in effect until 1985 despite criticism from a number of countries as being unfair. But in 1985, the PRC stopped publishing the favourable exchange rates applied to foreign trade (*maoyi neibu*) and nominally returned to single-sheet exchange rates. These single-sheet rates were nominal because, in effect, the two-tier system was kept unofficially, giving rise to a black market where both Chinese and foreign individuals in possession of foreign currencies aimed to convert their funds underboard, often through trade-licensed companies, for a more favourable exchange rate. During that period, the PRC devalued the RMB single-sheet exchange rate time and gain. In 1985 US\$ 1 was worth 2.95 RMB, but by 1993 it was worth 5.76 RMB (see Figure 1), a measure which clearly boosted China's exports and buildup of inbound FDI.

The next milestone in the evolution of the RMB dates back to 28 December 1993 when the State Council promulgated its intention of reforming the exchange rate mechanism. Aware of the malignant spread of a black market, the PRC undertook to genuinely strive for convergence between official and unofficial exchange rates. After an adjustment period, it was foreshadowed that the exchange rate would move into a partially floating mode along a band and that a Chinese intrabank market for foreign-currency reserves would be established (the 1993 official pronouncement to that effect can be viewed at: <http://www.pbc.gov.cn/publish/bangongting/91/1590/15900/15900...html>).

The impact of the new policy was felt by tourists the following year: as part of the two-tier rationale, foreign visitors had, since the early 1980s, had to purchase goods within China at designated venues by using RMB-denominated *Foreign Exchange Certificates* (FECs). Slightly smaller than RMB notes in design, these certificates were valued in practise above par, partly so as to promote tourist spending on local goods and services and to curb imports. Conversely, Chinese nationals requiring foreign currency for travel abroad were

subject to at-par exchange rates and to strict individual quotas; expatriate residents wanting to remit their salaries overseas also had to register with authorities. But, as of 1994, preferential-rate FECs were abolished following a drastic devaluation of the RMB official exchange rate. Foreigners were expected from then on to purchase RMB at local banks at the same exchange rate that Chinese individuals and firms would convert their foreign currency [48–50].

China's financial market reform gained further momentum as its first two bourses were inaugurated in 1991. More and more foreign banks were otherwise allowed to set up branches in China during the 1990s, although most could provide retail services in local currency only from the mid-2000s onwards. Gradually, more and more export businesses were allowed to switch from compulsory handover of foreign-currency revenue to voluntary conversion, thereby allowing greater liquidity of foreign assets in the interbank market. Arguably, the thrust toward internationalization of the RMB was held back by the Asian Financial Crisis of 1997–1999, when the dangers posed by free capital flows to emerging economies became apparent. Yet, as Liew and other scholars noted, although the value of other Asian currencies was plummeting during the crisis, China sought in the main to responsibly stabilise the region rather than further devalue its currency in a bid to maintain the competitiveness of its export industries ([51], see also [47, 52]). Ultimately, the Asian Financial Crisis also called into question the desirability of individual Asian countries maintaining a US\$-peg when the great bulk of their trade is intraregional in nature, as Ogawa has persuasively argued [53].

Today, despite the accretion of massive foreign currency reserves over more than three decades of export-led economic reform, China may still seem a long way away from a full floatation of the RMB in world financial markets. The RMB does not meet what are widely seen as basic requisites to do with internationalization in terms of financial market openness. As Chen and Cheung have shown, although the use of the RMB in trade financing overseas has increased rapidly in recent years; China still maintains strict capital controls, which render its financial system quite insular from global money markets. However, even Chen and Cheung acknowledge that the RMB “has great potential to become an international currency” and that its acceptance in the global economy is affected by *both* economic and *political* factors [54].

China has not yet reached the stage of unhindered capital account convertibility. On the other hand, China nowadays enforces greater current-account transparency and has been, since 2007, progressively grooming Hong Kong as an “off-shore” clearing house for the nascent global trade in RMB-denominated financial assets. Last year, the sanctioning of trade in RMB per se was announced in Hong Kong [55].

Concomitantly, the offshore RMB market has been growing steadily. Due to the US dollar shortage effect on trade experienced during the recent global financial crisis, the People's Bank of China initiated a scheme to allow settlement of *all* types of cross-border trade in RMB. In January 2011, China trialled for the first time RMB trading even in the USA [56].

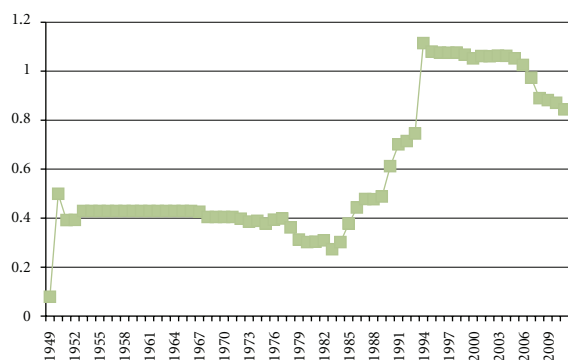


FIGURE 2: 1 HK\$ to RMB official exchange rate, 1949–2010.

To be sure, portentous signs of *politically* induced foreign investor amenability to, if not espousal of, the RMB as imminent global reserve currency may already be found beyond money markets, particularly in countries reliant on trade with China: Andrew Forrest, CEO of Australian mining stalwart Fortescue Metals, has recently declared, for example, that his company was “...now exploring the possibilities of being paid in *Renminbi*, purchasing equipment in *Renminbi* from our *Renminbi* bank accounts and bringing equipment into Australia and every other type of variety.” Forrest’s comments came a month after Rio Tinto, a British-Australian multinational mining and resources group with headquarters in London and Melbourne, had indicated it was considering settling iron ore sales in *Renminbi* because of pressure from Beijing to do so. But, in contrast to Fortescue Metals, Rio Tinto had no initial plans to start trading in *Renminbi* to offset its US\$ transactions [57].

The PRC has been slowly bowing to international pressure to revalue its currency along a narrow band as a means of reducing its trade surplus with the West. In 1994 US\$ 1 was worth RMB 8.6, but the rate dropped to 6.76 by 2010 (see Figure 1). Arguably, the greater adjustability of the RMB exchange rate achieved prior to 2008 was one of the factors, which helped China weather the Global Financial Crisis more effectively than the West. That said, many critics of the PRC suggest that this adjustment is too slow to assist recovery from the Global Financial Crisis of 2008 and that in the main it reflects the dollar’s weakening against other foreign currencies rather than a genuine worsening in Chinese terms of trade (for comparison, see Figures 2 and 3) [58].

Sources for Figures 1–3. Data for 1949 were compiled from the study by Li Dongrong [59].

Data for 1950–1978 compiled in the main from *Geguo huobi huijia tongji shouce* [60].

Data for 1979 to the present were mainly compiled from the State Administration for Foreign Exchange website: http://www.safe.gov.cn/model_safe/tjsj/rmb_list.jsp?id=5&ID=110200000000000000.

Notes for Figures 1–3. The Japanese Yen was floated against the US\$ in 1971. Prior to that, the Yen had been pegged to the dollar in line with the Bretton Woods accords at 360 : 1.

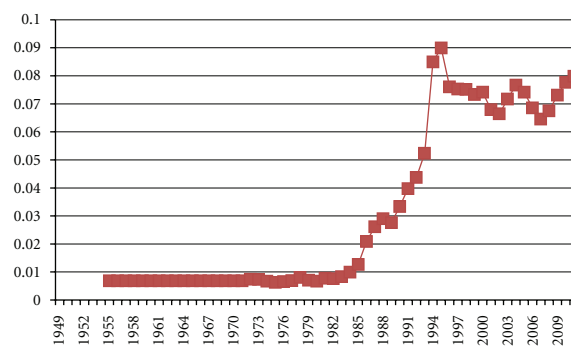


FIGURE 3: 1 Yen to RMB official exchange rate, 1949–2010.

The figures are corrected for the 1955 issuance of new RMB denominations at a rate of 1 to 10,000 old RMB. In 1983 the British colonial authorities in Hong Kong pledged to peg the HK\$ to the US\$ at a rate of 7.8 : 1.

In the second decade of the 21st century, the notion of China eventually becoming a dominant economy is seldom disputed; neither is the notion that China has been one of the most salient beneficiaries of post-1989 globalization (for an integrative discussion of globalization and China’s changing political economy, see [61, 62]). Its growing clout on the world stage is reflected geopolitically in important multilateral organisations such as the WTO and the G20. By now, there seems to be growing recognition on the part of China’s leaders of the potential benefits of greater RMB convertibility. Though China faces numerous economic challenges domestically, not least of which are environmental degradation and growing income disparity, there are signs of newfound confidence in China’s economic growth model to allow for further internationalization of the RMB. As indicated above, RMB-denominated bonds have been issued in Hong Kong by PRC state-controlled banks and conglomerates since 2007 (“dim sum bonds”). In recent years, they have been joined by foreign conglomerates with large PRC operations such as McDonald’s and Caterpillar. In January 2011, even the World Bank issued a series of “dim sum” bonds in Hong Kong. Within China, too, a select few multinational NGOs and banks were allowed in recent years to borrow funds on a trial basis from the Chinese public through the floatation of bonds in the domestic market (“panda bonds”): these include the IFC, the Asian Development Bank, and more recently, the Bank of Tokyo-Mitsubishi UFJ [54].

Moreover, experimental payment of RMB for some import goods from Southeast Asia has begun—this would have been unthinkable in the 1990s when it was illegal to take RMB out of the country. It may not be long before the RMB begins to play a significant role as an asset in other countries’ sovereign funds and to consolidate its appeal on the cross-rates as a result of *both* trade-related activity and broader financial demands. In the intermediate term, therefore, the pressure on the People’s Bank of China to revalue the *Renminbi* looks set to mount (for official news coverage of this bond issue see, <http://english.cntv.cn/20110614/103933.shtml>).

6. The Pros and Cons of Internationalising the RMB

In PBC thinking there is currently a set of quantifiable and intangible advantages associated with potentially allowing the RMB to be freely tradable outside China. The primary quantifiable advantage would be, of course, the ability to enhance “seignorage” revenue in its abstract modern form (as opposed to the metallic seignorage of pre-modern times). In addition, RMB tradability is likely to increase the volume of international financial transactions to be cleared in China and thus hold out the prospect of more premium jobs created locally and greater financial services tax revenue. The main intangible advantage would, according to conventional wisdom, accrue to PRC citizens and firms rather than to the PRC government, whereby lower exchange commissions would have to be advanced when transacting business overseas. Yet the PRC government is likely to intangibly benefit from greater “soft power” if the RMB was internationalised [63]. In this context, it is important to consider some economists’ estimates that the US derived a compounding windfall of US\$ 953 trillion between 1946 and 2002 purely as a result of the fact that the dollar was the main global reserve currency during that period. But the overall benefit to the US economy could have been manyfold bigger if intangible factors are factored in, according to a study by Chen et al. (The windfall was broken down to US\$ 678 trillion in seignorage-derived revenue and US\$ 274 trillion in financial benefits [63]).

Economists further suggest that, should the RMB become a regional reserve currency in East and Southeast Asia over the next decade, the Chinese economy could rake in a windfall of RMB 744 trillion, not to mention the impact on China’s geostrategic clout in multilateral organisations such as the WTO and G20 [63]. The most obvious downside to RMB internationalisation is associated in PBC thinking with the potential weakening of macroeconomic levers that have so far stimulated Chinese exports, for example, the managed-band exchange rate regime. Internationalisation would also pose the risk of Chinese nationals transferring assets overseas on short notice and allow for “hot money” to more easily penetrate the domestic economy and aggravate the already acute property bubble across much of the country’s eastern seaboard [64].

Clearly, China’s financial market is not sufficiently open at present to allow comprehensive RMB internationalisation. Notably, PRC nationals and firms still cannot independently purchase financial assets denominated in foreign currency. They are only able to invest in RMB in a select number of government-accredited foreign financial institutions or buy foreign securities only via a select number of state-controlled financial institutions. There is also lack of sufficient competition in the domestic financial market, with state-owned banks still accounting for the lion’s share of retail loans and credit. China’s own securities market only dates back to 1990 and is still not easily accessible to SMEs; credit is therefore skewed in favour of state-controlled large companies, often resulting in low returns to investment and misallocation of resources [65].

But many of the other preconditions for internationalisation have largely been met: China already accounts for large share of the world economy and has until recently been able to overcome inflationary pressures for the most part. Whilst capital-account movements across the border are still restricted, greater current-account convertibility is now permitted. In the face of financial market shortfalls, policy makers have of late gingerly moved to bestow on the RMB more international exposure. In June 2007 the first batch of RMB-denominated PRC bonds was floated in Hong Kong; in the following month the PBC set up a specialised Exchange Rates Department (*huilüsi*) with a mandate to promote the RMB’s internationalisation as well as to enhance its prestige overseas. Furthermore, in March 2010, the State Council approved an experimental global RMB clearing centre in Hong Kong which is to be extended onto 20 Mainland regional centres in the near future. Indeed, in October 2010, the 12th PRC Five-Year Plan reaffirmed that Hong Kong is to become a test ground for clearing global RMB-denominated transactions. Then, on June 1, 2011, the PRC government announced a new experimental scheme whereby accredited institutions and individuals without domestic representation would be allowed to directly purchase RMB overseas. Evidently, then, important initial strides toward RMB’s full convertibility have been completed over the last 3 years without any major shock recorded on the cross-rates (the wording of the June announcement can be viewed at, <http://www.pbc.gov.cn/publish/huobizhengceersi/3131/index.html>).

Notwithstanding the seemingly slow pace of reform in China’s domestic equity markets and the limited recourse nonstate firms have thereto, Chen and Cheung contend that nonresidents currently own PRC equities equivalent to 24 per cent of the country’s GDP, while nonresidents of Japan own domestic equities amounting to only 17 per cent of Japan’s GDP. This factor, amongst others, seems to lead them to predict that more RMB-denominated bond issues and greater overseas trade volumes would of themselves turn the RMB into a global currency in the not-too-distant future) [54]. Moreover, Chen and Cheung report that the cumulative volume of nonfinancial trade settled in RMB increased from less than RMB 4 billion at the end of 2009 to RMB 290 billion by November 2010. Similarly, RMB-denominated bank deposits in Hong Kong have experienced an annualised growth rate of 450% in recent months. Currently making up around 5% of the total volume of Hong Kong bank deposits, RMB-denominated deposits may well come close, within a few years, to the 30.8% share which US\$-denominated bank deposits hold in the former Crown Colony [54].

7. The Debate among Western and Japanese Scholars

In his classic 1960 study, Robert Triffin suggested that the US\$ became international reserve currency sometime after World War II, namely, more than half a century after the US became the largest economy in the world [66]. But in their more recent important study Eichengreen and Flandreau analysed the makeup of international reserves in the interwar period, and found that the US\$ had actually overtaken

the pound sterling to become the leading reserve currency as early as the 1920s. During the subsequent decade, despite short-term global currency tribulations arising as a result of US\$ devaluations, the US\$ became all but indispensable to international trade [67].

Against the backdrop of progressive dollar devaluations and what hitherto seemed like well-functioning European Monetary Union, Eichengreen and Flandreau concluded that the global monetary system could be re-made over a relatively short period of time; they even alluded to the fact that the Euro might well be on its way to unseating the greenback as preferred reserve currency. Perhaps more germane to the issue under review, Eichengreen and Flandreau also suggested that network effects and the advantages of incumbency should not be overestimated when weighing up the possibility of an emerging global currency “dethroning” a more established global currency [67].

Historic experience and economic theory suggest that in order to become global reserve currency a few preconditions need to be met simultaneously: the home economy of this currency needs to demonstrate stability and low inflation; the volume of the home economy should be the largest in the world; the home country must possess mature and solvent financial system [68]. The US has been the largest economy in the world throughout the 20th century and maintained low inflation during that period. At the same time, the US financial system was the most elaborate and invasive as measured, for example, in the ratio of publicly listed equity to GDP. It was the sheer scope and transparency of the New York money market that helped entrench the greenback as global reserve currency [59].

That said, the domestic subprime crisis of late 2007 which quickly deteriorated into the Global Financial Crisis of 2008 had stemmed from regulatory flaws in the very same financial system. The Crisis revealed deep structural distortions in the US economy like overconsumption, mammoth government deficit, and excessive risk incentives to corporate executives—these have cast doubts on the dollar as *single* viable reserve currency not least among Asian central banks. But talk of the RMB eventually supplanting the dollar in the financial press may not have necessarily emerged as a result. Rather, what triggered speculation of imminent RMB internationalization was the bleak forecast for economic performance in other parts of the developed world: crises in Spain, Ireland and Greece weigh heavily on the prospects of the Euro complementing the greenback as a more serious reserve currency, whilst the viability of the Japanese Yen—once mooted to supplant the greenback—has been tarnished since Japan’s “Lost Decade” of the 1990s.

As a rapidly industrialising economy, which has posted double-digit annual growth rates over the past three decades, China quite obviously draws more global attention. It would appear that the RMB came to the fore as a future alternative to the greenback mainly as a result of the fact that China’s banks performed much better than Western ones through the Global Financial Crisis. Until not long ago prominent economist such as Nicholas Lardy had identified China’s banking system as the weakest link in its development model [42]. Yet the fact that—contrary to Europe and the US—no

major bank bail-outs were reported in China; that a growth rate of over 9% was still achieved between 2008 and 2009, and that China has now overtaken Japan as the world’s second largest economy may well have psychologically primed Western public opinion to consider more seriously what appears to be a long-term historic shift of power from West to East.

Takatoshi Ito has argued that the PRC economy has proven so resilient because it has benefitted from underlying demographic dividend. Based on UN demographic statistics, Ito came to the conclusion that China would become the largest economy in the world no later than 2027. Apart from endogenous factors, Ito believes that the Global Financial Crisis provides the Chinese economy with a golden opportunity to stamp its mark geostrategically [69]. As the US is coming to the realisation that the financial market deregulation it has espoused as part of the so-called “Washington Consensus,” as well as the very neoclassical theory that consensus is underpinned by, irreparably tarnished Wall Street’s reputation, more and more commentators are betting on the alternative “Beijing Consensus” as an engine of growth in emerging markets precisely because of its more cautious approach to economic theory and market deregulation [70, 71].

8. What Do Chinese Economists Think?

Zhou Xiaochuan, the PBC Governor, has on a number of occasions stated his view that the RMB need not supplant the greenback as global reserve currency. Rather, Zhou supports the creation of a new composite international currency along the lines of the SDR—one that cannot be controlled by a single sovereign state and that would transcend narrow national agendas by factoring in the price of commodities such as gold. Nonetheless, a PBC study group set up by Zhou found that in the intermediate term it might be desirable for China to enhance the role which RMB plays in trade with neighbouring Asian countries as part of an emerging regional trade bloc, whereas today much of that intra-Asian trade is carried out in US\$ even though US firms are scarcely involved therein. Such a regional experiment could help coordinate RMB overseas exposure and help gain experience in averting currency instability in the future [72].

Within Chinese academe one can find a wider range of views. Economists are divided on the question of whether RMB internationalisation is desirable, and if so, at what pace. Li Daokui of Tsinghua University—arguably the academic whose views have proven most influential in this debate—is in favour of a stalling tactic whereby China would achieve free capital-account convertibility over a long period of time. Li et al. advocate a two-track gradualist approach: domestically, he sees no need to immediately allow full RMB convertibility and instead emphasises the need to improve the efficacy of China’s financial system; on the other hand, Li et al. support a more rapid expansion of trade in RMB-denominated assets in Honk Kong with more PRC bond issues there and eventually the setting up of a second Hong Kong bourse exclusively dedicated to trade in RMB-denominated equity [73].

Prominent Hong Kong-born economist Steven Ng-Sheong Cheung (known in China as Zhang Wuchang) has for many years opposed any revaluation of the RMB believing that it would only benefit a small coterie of wealthy PRC nationals who frequently travel overseas. China's most vulnerable population—rural migrants seeking employment in labour-intensive factories—would according to this theory be hard hit should foreign investors opt to relocate production lines to other countries as a result of RMB appreciation. In Cheung's typically conservative assessment, exchange rate predictability should firmly remain the anchorage of China's developing economy, whilst domestic market forces should perhaps be allowed to play a greater role in PBC interest-rate mechanisms. In contrast to Zhou Xiaochuan, Cheung does not believe in promoting a new composite global currency because the value of such a currency might be swayed by the volatile price of alternative global assets like gold. Instead of the current US\$ peg, Cheung proposes—against the backdrop of rising US indebtedness—to affix the value of the RMB to a basket of 30 foreign currencies and perishable goods, whilst providing the rural poor with a range of subsidies to alleviate the negative impact of a likely RMB appreciation [43, 44].

Larry Hsien-Ping Lang (Lang Xianping), a business scholar known for his outspoken opposition to State-Owned Enterprise reform, weighed into the RMB debate from the opposite direction. Lang pointed out that the problem with likely RMB appreciation as a result of internationalisation emanates from the current structure of the Chinese economy, which is fixed-investment driven and export-led rather than consumption and services based as in developed countries. Prior to RMB internationalisation, Lang argues that China would have to combat its inadequate domestic consumption rate by laying more social-security nets that would encourage the middle and lower classes to save less of their income. In the short term, however, Lang believes that the RMB is too devalued at present because it does not sufficiently factor in US-induced inflation: while this might seemingly promote employment in China's industrial export sector, the positive effect is *outweighed* by higher imported food staples (e.g., soy) and commodity prices (e.g., oil and iron ore). These in turn put upward pressure on the price of domestic goods, with a net outcome of making the poor even poorer, constraining consumption, and endearing industrial inputs [74].

Prominent neoliberal economist Chen Zhiwu, now based at Yale University, shares by and large Lang's observations. In Chen's view, the RMB's excessively slow appreciation against the US\$ is accentuating structural imbalances in China's economy, not least of which is loss of government control over the general price level particularly in the property and equity markets. Conversely, China's foreign reserves keep piling up, and hot money pours into the country fuelling a speculative boom that is hurting the country's strategic reliability overseas. Foreign speculators are attracted to China in part because the appreciation pace of the RMB has been made so predictable by government policy over the last decade. Furthermore, according to Chen the overly devalued RMB is stalling the much needed transition of Chinese

industry to more sophisticated, capital-intensive products, whilst suppressing income in the bottom percentiles of the social-economic ladder [75].

Returning to the other end on the spectrum of views, the Senior Vice President of the World Bank, Lin Yifu, has recently warned that, in view of the slow pace of US economic recovery, any further revaluation of the RMB will immediately dampen consumption of Chinese goods in the US. Because most of these goods are not readily produced within the US, this will result in a further blow to net consumption in the US, setting back the recovery. In the longer run, Lin does recognise the need to increase Chinese domestic consumption but adds that a more important means of achieving balanced bilateral trade would be for the US to trim its government deficit. For Lin therefore stability in China is critical to world economic recovery at present, and any experimentation with market forces could jeopardise these aims [76].

9. Conclusions

Amid an emerging debate in the West about the prospects of other currencies or precious metals supplanting the US\$ as leading global reserve, this paper has sought to draw insights from the past in an effort to contextualise China's historic role in international currency provision over the *longue durée*. It has shown that, strictly speaking, there was no truly global currency before the discovery of rich silver deposits in Latin America and the spread of the Spanish-American silver dollar in the 17th century.

Nonetheless, well before the discovery of the New World, traditional Chinese copper “cash” had served as a model for Japan and Korea's first indigenous currencies. Copper “cash” was also sought after in many parts of Southeast Asia, where previously South-Indian-modelled gold and silver currency had been in use. Notably, in the mid-12th century, Japan imported large amounts of Chinese copper coins, even though it was more copper abundant than China, and not bereft of metallurgic knowhow. Invented in China as early as the 11th century yet largely phased out by the 14th century, banknotes came into use in Europe only in the 17th century and spread continuously thereafter. It is arguably this temporal divide which might help explain the varying degree to which Chinese emperors and European monarchs aimed at enhancing seignorage revenue.

The current preoccupation with RMB as future international currency is not entirely devoid of the historic context of Chinese financial evolution. For even though traditionally cast Chinese copper coinage gave way to Western steam-powered minting technology in the late 19th century, it had for a millennium or so prior set the benchmark for East and Southeast Asian monetization. Even as China was phasing out traditional copper coinage, Chinese indentured labourers were still taking it with them aboard British ships sailing across the South Pacific to serve as community currency for gambling and grocery purposes.

Today, of course, any global role which China's currency might play on the world stage would be divorced of the

metallic anchorage which typified the monetary development stage prior to 1971. That year, following the breakdown of the Bretton Woods accords, most currencies of the world were beginning to slough off their linkage with gold, thereby circulating as media of exchange purely by state fiat. It would be careless to compare the pre-modern and current phases in the evolution of China's currency without recognising this ponderous difference. Yet, by the same token, one can still find resonances across starkly different eras in that quite often in history financial assets flowed into China from the West to offset surplus Chinese exports.

Faced with a rapidly growing Chinese economy, many pundits are forecasting that the RMB would soon become the world's reserve currency in lieu of the US\$. Such predictions are devoid of a historic context for the most part, and nor are these essential in arguing the case. Others contend that the deficiencies of China's financial market would continue to preclude any such transformation for a long time to come. This paper surveyed the arguments put forward by either camp, and weighed into this debate not only through the prism political economy but also through the prism of economic history. Chinese economists are mostly in favour of RMB gradual revaluation, arguing that it would be a boon to Chinese consumers, but some warn that a rapid appreciation could risk global recovery. The prevalent view as well as new policy measures suggest that, short of imminently floating the RMB, a further revaluation is highly likely.

If and how soon the RMB might supplant the greenback as global reserve currency is much harder to predict. Although RMB floatation is likely to benefit the Chinese economy in the long run, it is for now mainly advocated by economists associated with neoliberal views. At the policy-making echelons, figures like PBC Governor Zhou Xiaochuan disapprove of overt challenge to the US\$. Instead, they ultimately see the RMB as one of many monetary and commodity complements to the US\$ in establishing a new global standard. In the broader scheme of things, therefore, the extent to which the RMB would go global in the near future may not be determined solely by domestic financial and equity-market reform moves but, more importantly, by the overall geostrategic posture which China opts to embrace vis-à-vis the IMF, the World Bank and the G20; by the development model China implements and the shade of hegemony it chooses to exercise, as a *resurgent* superpower.

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Research Article

Implications of the Global Financial Crisis for China: A Dynamic CGE Analysis to 2020

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The global financial crisis resulted in a significant downturn in the global economy, with impacts felt throughout the world. In this paper, we use a dynamic global general equilibrium model to explore the longer-term impacts of the financial crisis, with a particular focus on China. The economies of most countries suffered to some extent, with the extent of declines in the long run likely to depend on the extent to which investment declines. Our results suggest that overall the financial crisis leads to international trade falling by approximately 14 percent from the 2020 baseline level. Within this, the composition of trade changes, particularly reflecting changes in demand for construction of investment goods and increasing longer-term demand from economies like China. We also briefly consider the impact of a more protracted recovery from the crisis, which has even more significant impacts on the global economy.

1. Introduction

The global financial crisis resulted in a significant downturn in the global economy. Although the worst of the crisis appears over at the time of writing, the global recovery “remains exposed to significant risks” (2011). This paper uses a dynamic computable general equilibrium (CGE) model to explore some potential effects of the global financial crisis for China.

To examine the impacts of the crisis, we use GDyn, a dynamic global CGE model, developed by Ianchovichina and McDougall [2] and based on the GTAP model [3]. The GDyn model incorporates most features of the GTAP model, including bilateral trade flows, a sophisticated consumer demand function and intersectoral factor mobility. In addition, GDyn tracks foreign ownership of capital and investment behavior. This allows us to include the impacts of endogenous capital accumulation and the movement of investment between countries in response to differing expected rates of return. Use of a dynamic model also allows us to model consecutive periods of the crisis and the consequent time-path of adjustment for each economy. While

GDyn has an improved treatment of investment relative to the GTAP model and captures errors in expectations, it does not model debt obligations or money and, therefore, does not purport to explain the financial crisis. Thus, we use the model to mimic key macroeconomic impacts of the financial crisis, in an effort to shed light on the longer-term impacts of the crisis for China.

We first explain the model and develop a baseline scenario for GDyn, which depicts how the global economy might have evolved without the impact of the global financial crisis. This is then compared with results arising with the global financial crisis. We also consider the potential impacts of a slower recovery from the crisis. Finally, we offer some concluding comments, including discussing some limitations of the current study.

2. Model and Baseline Scenario

The GDyn model incorporates a treatment of investment that relies on (a) the gradual elimination of errors in expectations, (b) the gradual equalization of rates of return to investment, and (c) the gradual movement of economies towards

steady-state growth [2]. We adapt the model for our current purposes to include endogenously determined employment of skilled and unskilled labour, along with capital.

In combination with the GDyn model, we use version 7 of the GTAP Data Base, which has a base year of 2004 [4]. This database is augmented with supplementary data required for the GDyn model [5]. The 113 countries/regions and 57 sectors in the full GTAP Data Base are aggregated to 29 regions and 27 sectors. However, we focus here on results for China, contrasting them with a limited selection of other countries.

2.1. Developing the Baseline Scenario. Before examining the impacts of the global financial crisis, we first develop a baseline for the model which represents how the global economy might have looked in the absence of the crisis. The development of a baseline is an important component of the experimental design when using a dynamic model [6]; however, building a suitable baseline is a complex task.

Given the difficulties in creating a baseline for the GDyn model, previous baselines have focused on obtaining projections for a few key macroeconomic variables, such as real GDP, population, skilled and unskilled labour, along with implementation of key policies which have already been agreed upon and are expected to affect the regions/sectors being considered [7]. An alternative approach, developed by Dixon and Rimmer [8] for single country model baselines, uses a series of simulations (historical, decomposition, and forecasting) to develop a baseline scenario. We use a combination of these approaches, focusing on the path of the macrovariables. Previous work with GDyn indicated that the way we model errors in expectation and productivity changes tends to have significant impacts on the baseline [9]; therefore, we focus particularly on improving the specification of these. Key aspects of our baseline are summarised below.

2.1.1. Data Sources. Historical data were collected primarily from the World Development Indicators for available countries [10]. Some additional data for the Asian economies were also collected. (We are grateful to Ginalyn Komoto and Susan Stone, previously of ADBI, for their assistance in collating this additional data.) Historical data were generally found to be particularly good prior to 2006. We use the available historical data to find average annual growth rates and construct a historical baseline. We then include the following variables in the baseline: real GDP, investment, consumption, government spending, population, and skilled and unskilled labour.

2.1.2. Structural Change and Sectoral Productivity. A range of alternative assumptions are possible with respect to sectoral productivity differentials over time. Ngai and Pissarides [11] discuss two competing explanations for structural change: the technological explanation attributes it to differences in sectoral rates of total factor productivity, while the utility-based explanation relies on different income elasticities for different goods leading to structural change. However, these two explanations may coexist [11], and, in the current

work, both contribute to structural change over time in the economies we model. We retain the standard GTAP approach to modelling utility and income elasticities [3, 4], therefore, we concentrate here on explaining the approach taken to modelling sectoral productivity growth.

The assumptions we make on sectoral productivity growth broadly follow the approach of Hertel et al. [12] and Golub et al. [13], which based nonagricultural productivity growth on economy-wide labour productivity growth rates, adjusted for productivity differences across sectors. We update the labour productivity differentials using the latest available OECD estimates, (which provide estimates from 1995–2003, contrasting with previous estimates based on 1970–90 data) employ greater sectoral differentiation and also apply this approach to agricultural sectors. Sectoral differentials for labour productivity growth rates are derived from the OECD STAN data [14]. These data provide estimates of labour productivity in terms of the amount of value added per unit of input. Following the approach of Kets and Lejour [15], these indexes of sectoral labour productivity growth are averaged across countries. (We use a simple average as recommended by Kets and Lejour for this kind of labour productivity data.) To estimate sectoral differentials, the average growth in labour productivity growth for each sector is assessed relative to average labour productivity growth. Other studies have employed different assumptions for land-using sectors, taking into account the productivity of all inputs, rather than just the value added [12, 13, 16].

Table 1 summarises our estimated sectoral productivity differentials, following the approach outlined above. Consistent with previous studies, a relatively high level of productivity growth is indicated for agricultural sectors. In addition, certain other sectors also experience relatively high productivity growth, particularly some of the manufacturing sectors such as electronics, machinery, and motor vehicles. These findings are broadly consistent with the earlier work of Kets and Lejour [15], including the finding of particularly high growth rates in the transport and communication sector. Since we define these sectoral differentials as the ratio of labour productivity growth in each sector to the economy-wide average, they are implemented for each region by multiplying by the *base* factor productivity growth rate for each region. Thus, although we only present sectoral differentials in Table 1, the effective impact of these differentials will vary significantly by regions, with the relatively rapidly growing economy of China having a high base factor productivity growth rate.

2.1.3. Calibration of the Baseline. As outlined in Walmsley [7], historical investment can be accommodated in one of two ways: (a) by introducing an additional risk premium to explain the difference between actual and model determined investment or (b) by introducing errors in expectations. The difference between the two alternatives stems from assumptions regarding their permanence into the long run. In the first case, large risk premiums may be created by low investment in some countries, and these risk premiums are permanent, and; therefore, low investment remains in the long run. This method would be appropriate for a country

TABLE 1: Estimated sectoral productivity differentials.

Sectors	Productivity differentials	Sectors	Productivity differentials
Agriculture and forestry	1.75	Chemicals, rubber, and plastics	1.62
Processed foods	0.60	Metals	1.54
Extraction	1.42	Metal Products	1.17
Textiles, apparel, and leather products	1.39	Other manufactured products	1.17
Wood and paper products	1.63	Utilities	1.76
Motor vehicles	2.12	Construction	0.27
Electronics	3.71	Transport and communication	2.14
Other machinery	2.55	Business services	0.47
Petroleum and coal products	1.61	Housing, education, and health	0.33

Source: authors' estimates based on OECD data [14].

like China where recent increases in investment are thought to be the result of a more open policy towards foreign trade and investment in general, resulting in a permanent fall in the risk premiums and a permanent rise in investment. In the second case, large differences in historical and model-determined investment are assumed to be the result of large errors in expectations by investors. Eventually, investors will realize they have been making errors, and; hence, these errors will be eliminated, and investment will adjust in the long run. This method is more appropriate for a country where investment cannot be completely explained by rate of return differentials or differences in risk premiums. For instance, many commentators and economists did express concerns about the, seemingly unexplainable, continuous inflow of foreign investment into the USA and ballooning trade deficits for many years prior to the crisis. Since the difference between the two methods is simply how permanent the change is, we chose not to make ad hoc judgments of each country but instead use the term “errors in expectations” and then allow the actual data and forecasts to calibrate how the errors change over time with and without the financial crisis. The reader may choose to substitute “risk premia” wherever they see “errors” if they wish.

We simulate a business-as-usual scenario from 2004 to 2007 to calibrate the changes in errors in expectations required to explain the actual investment over this period, and we use real GDP data to calibrate technological change in the baseline. (This calibration baseline is based on and utilizes some of the findings from the work undertaken by Walmsley and Strutt [9] using the GTAP 6 Data Base.) We find that the errors in expectations are generally consistent and positive over the period. Relatively high errors in expectations tend to be found in the developed (and some developing) economies, suggesting that investment tends to be higher than what theory would predict given the current rates of return. The resulting errors in expectation for the US, Japan, and the EU are also consistent with the hypothesis that actual investment has been higher than what current rates of return would predict, due to large errors in expectations (or low-risk premiums). We include these calibrated errors in expectations in the baseline and assume that these errors in expectations continue to be held in the baseline over the whole simulated period 2004–2020. We also extend the

TABLE 2: Average annual changes in selected exogenous and endogenous variables in the baseline, China and selected countries.

	China	Japan	US	EU27
Real GDP	11.05	1.97	2.91	2.44
Technological change	5.38	2.00	1.32	1.67
Population	0.25	2.42	4.63	1.83
Real investment	16.25	0.45	4.43	1.55
Errors in expectations/risk premia	16.26	17.12	20.33	18.35
Real supply of unskilled labour	1.23	-0.16	1.21	0.17
Real supply of skilled labour	3.69	-0.66	1.22	0.31

average annual shocks obtained from the calibration of key macrovariables out to 2020. The results from the calibration are shown for selected countries in Table 2.

3. Scenarios Modeled

While the GDyn model has improved our ability to track foreign capital flows, as discussed earlier, the model does not profess to be useful in predicting the extent of the financial crisis. Our aim is, therefore, to mimic the behavior of the crisis to assess the likely impact on production and trade. We also consider the impact of a more protracted recovery period.

3.1. Financial Crisis Scenario. The *financial crisis* Scenario models the impact of the financial crisis through four mechanisms with investment recovering to precrisis levels in 2012. First, we argue that the financial crisis was caused by investors readjusting their expectations of the US and EU returns on investment relative to other countries, in light of news about fundamental problems with the US banking system that also affected the viability of the EU banking system. This is implemented by calibrating the changes in errors in expectations required to track changes in (forecasted) investment in each region between 2007 and 2011, as estimated by the World Bank [17]. We find that expectations of rates of return have been adjusted downwards across the world as investors reevaluate their expectations about the profitability of their investments as a result of the financial crisis. The global

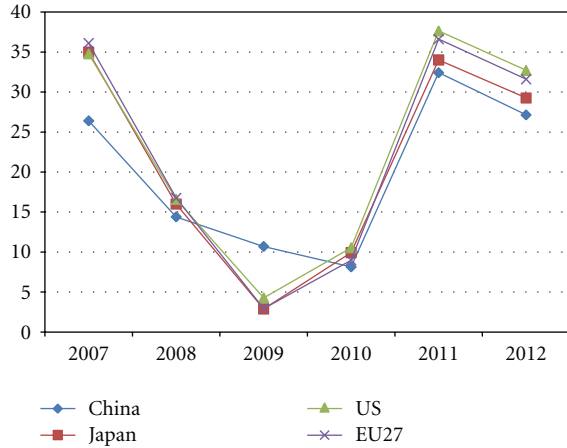


FIGURE 1: Path of errors in expectations for China and selected countries with *financial crisis*.

decline in expectations, however, hides the fact that the readjustment has not affected all economies equally. Figure 1 indicates that China moved from being in the bottom position in 2007 to the highest in 2009, in terms of expectations, while the relative positions of the US and Europe have moved in the opposite direction. This pattern reflects the fact that investment in China has been less affected by the crisis than the US and Europe. In 2010 and 2011, expectations rise again, with the US and Europe returning to their relative precrisis positions with higher expectations than China. Therefore, in this scenario, we assume that after 2011 the crisis is essentially over, and the relative attractiveness of investment returns to precrisis levels. (Note that while this assumption was in line with the World Bank forecasts, it could also be argued that changes in relative errors in expectations may continue. That is US errors (and investment growth) might be permanently lower than the baseline. This reflects the fact that economists have for some time argued that the rate of growth of the US trade deficit is unsustainable and that adjustments would eventually be required to bring it back into a long-run sustainable equilibrium. Under this assumption, there is a readjustment of investment across regions, and as a result some countries (e.g., China) experience increased investment which leads to increased capital accumulation and growth in the long run, at the expense of the US economy. Strutt and Walmsley [18] explored this possibility, and it appears an area worthy of future study.)

Second, in addition to the changes in expectations about future returns to capital/investment, we argue that the crisis causes an immediate but temporary decrease in efficiency and return to capital in all countries. Between 2007 and 2011, this decrease in efficiency is obtained through calibration to the decrease required for real GDP to decline by expected impacts of the crisis [17]. With the exception of the US, the baseline changes in technology in 2007 were similar to previous years, and these, along with the changes in investment, and employment explained most of the change in real GDP in that year. Hence no decline in capital efficiency was experienced outside the US in 2007. After 2007, the contagion affects of the crisis could be felt on

TABLE 3: Calibrated changes in technological change and capital efficiency due to the crisis, China and selected regions.

	2007	2008	2009	2010	2011
China	0.00	-3.16	-8.44	-5.64	-2.92
Japan	0.00	-1.11	-3.13	-4.97	-3.07
US	-0.54	-1.55	-4.10	-5.36	-4.75
EU27	0.00	-1.22	-3.05	-3.38	-3.21

capital efficiency across the world, with impacts for China and selected countries indicated in Table 3. After 2011 the decrease in efficiency of capital is assumed to end, returning to baseline levels by 2012.

Third, unemployment of skilled and unskilled labour and capital are modeled through a complementarity [19], which sets employment equal to the natural rate of employment, unless real wages must fall by more than a threshold rate to achieve this. (The threshold rate is greater than zero because there is some evidence that real wages have declined in response to the crisis. The threshold rate depends on the extent to which unemployment is higher than the natural rate of unemployment, where the relation is non-linear. It is assumed that as unemployment rises, the extent to which workers will accept declines in their wages increases. Note that this threshold rate can be altered, depending on the extent to which we believe real wages are flexible.) If real wages are required to fall by more than this, we fix the change in real wages at this threshold rate and allow employment to adjust endogenously. In the next period, the employment rate will attempt to move back to the natural rate again, but this will only be achieved if to do so requires less than the threshold percentage change in the real wage. If a larger decline is required, the change in the real wage will be fixed, and the employment rate will again be determined endogenously. Provided the economy does not continue to be hit by negative shocks, employment is expected to gradually move back to full employment.

Fourth, we include implementation of some of the known fiscal stimulus. (For further detailed country information on stimulus packages for WTO member countries, see the WTO reports [10, 17].) The global financial crisis led to substantial and rapid responses, with many governments implementing stimulus packages in an effort to dampen the impact on their domestic economies [17, 20, 21]. However, it is difficult to precisely quantify the fiscal stimulus packages being implemented, with the absence of a standard definition of implementation making cross-country comparisons very difficult [22]. In Table 4, we provide a summary of the government spending growth. The growth in government spending increased significantly in 2009 for some countries, including the US, EU, and particularly Japan, with some tapering-off suggested for 2010 and 2011. We note the tendency to focus on fiscal stimulus, in contrast to the Great Depression of the 1930s [23]. The implications of this are important since monetary stimulus benefited the initiating country but had a negative impact on its trading partners, while the use of different fiscal stimulus policy instruments today tends to benefit trading partners as well as

TABLE 4: Fiscal stimulus: assumed government consumption growth rates (%).

	2007	2008	2009	2010	2011
Australia	2.4	3.6	4.0	3.5	3.0
China	11.2	10.7	10.0	10.2	9.0
Hong Kong	3.0	1.7	5.0	4.0	3.0
Taiwan	0.9	1.1	12.0	8.0	7.0
Japan	1.9	0.8	6.5	4.0	4.0
Korea	5.4	4.2	6.0	5.0	4.0
India	7.0	20.3	10.0	5.0	4.0
US	2.1	2.9	4.0	4.0	3.0
EU ^a	2.2	1.6	3.7	3.1	2.3
Russia	3.4	2.4	1.0	1.0	3.0

^a Euro zone.

Source: World Bank [17].

the country implementing the stimulus [23]. (Albeit many of the stimulus packages currently being implemented do include “buy local” clauses.)

We assume that the fiscal stimulus diverts savings from investment towards funding of fiscal deficits. (Ordinarily the GDyn model would divert income from both savings and private consumption towards government spending. We have allowed the diversion to be greater on savings for two reasons: first, government must pay for these deficits through increasing debt and so reduce savings available for private investment, and, secondly, it allows us to capture the global decline in savings available for investment.) The fiscal stimulus and decline in savings are incorporated over the period 2007 to 2011. After 2011, no further changes are made, so that the share of government spending and savings are assumed to remain fixed.

3.2. Extended Financial Crisis Scenario. In the previous, case we used the World Bank forecasts to calibrate forecast changes in investment and real GDP. The calibrated changes in errors in expectations show that there is an expectation that after 2012 errors in expectations and investment would go back to precrisis levels. The second scenario of an *extended financial crisis* models the impact of a more protracted financial crisis, with investment recovering only gradually after 2010 and not returning to precrisis levels until 2015. As in the first scenario, the changes in errors in expectations in the US, Europe, and the rest of the world are found by calibration between 2007 and 2010. After 2010, errors slowly adjust so that investment growth rates return to baseline levels by 2015 (not 2012, as in the first scenario). Moreover the temporary decrease in efficiency continues to 2015, albeit the decline is gradually eliminated so that by 2015 the technological change has returned to baseline levels.

4. Results and Discussion

We focus particularly on the first *financial crisis* scenario, before briefly exploring potential implications of an *extended financial crisis*.

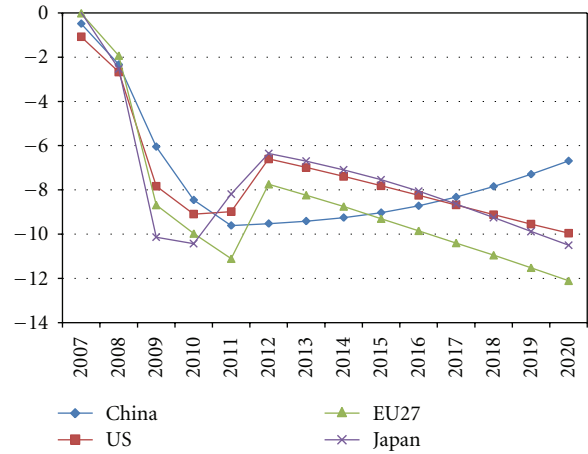


FIGURE 2: Cumulative differences in real GDP, selected countries, relative to baseline (%).

Table 5 presents the macroeconomic findings for China and selected countries under the *financial crisis* scenario, with all results being cumulative percentage differences from the baseline in 2020. (To interpret the results, take the example of Chinese real GDP of -6.7 percent: this means that in 2020 China's real GDP would be 6.7 percent lower than it would have been, had the crisis not occurred.) There are sometimes considerable differences between the short run (2010) and long run (2020), with real GDP results shown for both 2010 and 2020.

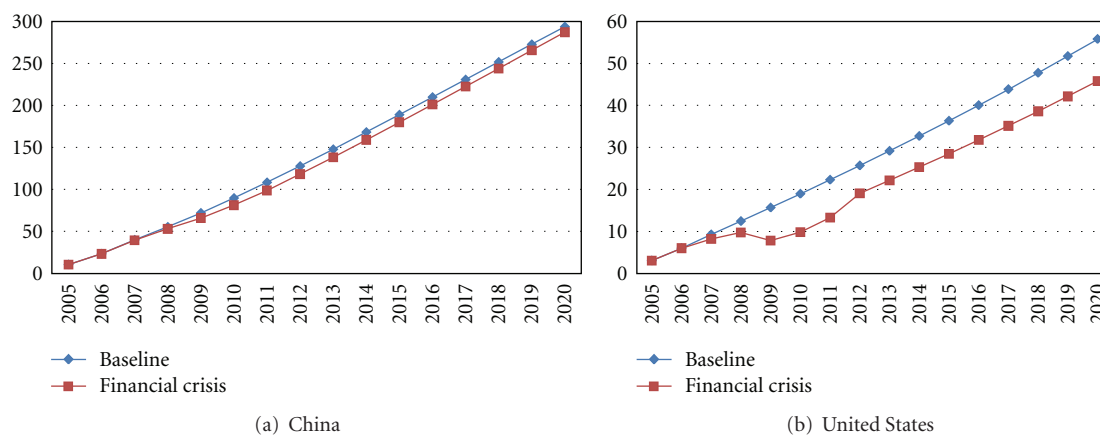
Given our assumptions for the *Financial Crisis* scenario, a key impact will be lower real GDP, with the most significant losses occurring between 2007 and 2011 (Figure 2). During this period, all economies experience a downturn relative to the baseline as capital efficiency, trade, and employment fall. The subsequent rate of recovery is related to the gains in investment, with investment moving towards those countries with the highest relative rates of return. China is able to partially recover the reductions experienced in 2010 GDP, with the cumulative impact on real GDP approximately 2 percent smaller in 2020 than in 2010. However, as Figure 2 shows, for the US, Japan, and particularly the EU27, the reduction in GDP due to the financial crisis is even greater in 2020 than in 2010. This reflects ongoing reallocation of investment away from these regions in our modeling results.

Figure 3 illustrates the cumulative growth in real GDP for China and the US in the baseline and as a result of the crisis, with the difference between the two curves representing the impact of the crisis. There is a fairly pronounced impact on the US economy, given that growth rates even without the crisis were likely to be relatively modest. However, for China, growth rates are only marginally affected, particularly when considered relative to the strong gains projected over this period to 2020.

The changes in investment summarized for China and selected countries in Table 5 indicate some significant differences, reflecting the fact that the financial crisis has resulted in a readjustment of investment globally. This relocation of investment is also reflected in the adjustments of the

TABLE 5: Cumulative difference in selected macroeconomic variables, *financial crisis* relative to 2020 baseline in China and selected countries (%).

	Real GDP in 2010	Real GDP in 2020	Investment	Real exports	Real imports	Change in trade balance (US\$b)
China	-8.5	-6.7	27.6	-20.1	-10.1	-222.5
Japan	-10.4	-10.5	-32.5	-20.6	-13.7	15.6
US	-9.1	-9.9	-38.4	-8.5	-18.3	388.8
EU27	-10.0	-12.1	-29.7	-16.2	-15.8	286.9

FIGURE 3: Cumulative changes in the *baseline's* and *financial crisis's* real GDP (%).

trade balances. For example, China experiences a 28 percent increase in investment and a decrease in its trade surplus, relative to the 2020 baseline. (We do not specifically constrain trade imbalances over time, and, in the baseline, China's trade surplus continues to increase. However, some argue that this imbalance is unlikely to be sustained over time [24].) This suggests that, in the longer term, the financial crisis leads to an increase in the relative attractiveness of producing investment goods in China. Moreover, this increase in investment is likely to have continued positive effects on China after 2020. In fact, by 2020, the yearly growth rates under the crisis are higher than those in the baseline (see Figure 4). As this continues into the future, eventually the cumulative growth rates in real GDP will exceed those in the baseline, and China will have gained from the financial crisis.

In terms of production, Table 6 indicates that China, with its large increases in investment, consequently experiences large increases in construction. For example, increases in investment in China due to the financial crisis drive a 25 percent increase in construction relative to the 2020 baseline. On the other hand, countries such as Japan and the US experience a reduction in investment, with the construction industry in these countries experiencing a substantial decline in output relative to the baseline.

Given the overall decline in global investment due to the crisis, we find the world construction industry is particularly hard-hit in terms of reduced output. We also find relatively significant reductions in global output of manufactured products. In general terms, sectors which are not so capital intensive tend to be relatively less adversely affected by the

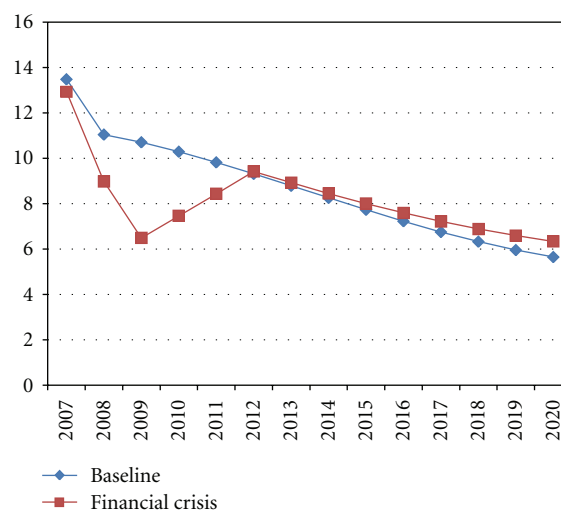


FIGURE 4: Year on year growth in real GDP in China under the baseline and with the crisis (%).

financial crisis than those that are capital intensive. (See Strutt and Walmsley [25] for further discussion of these issues.) In China, sectoral output declines significantly less than the world average in all sectors except services (which is roughly equal to the world average). In fact, production of capital goods and construction in China increase due to the *financial crisis*.

Most countries also reduce exports and imports relative to the 2020 baseline, with Table 5 indicating the overall

TABLE 6: Cumulative difference in real output due to financial crisis, China and selected countries, 2020 (%).

	China	Japan	US	EU27	World's total
Crops	-4.2	-6.3	-5.3	-8.5	-6.8
Animals	-4.7	-14.9	-8.4	-12.4	-8.9
Food processing	-8.1	-12.0	-9.4	-11.9	-10.5
Forestry and extraction	-3.3	-12.2	-6.5	-7.9	-6.6
Light manufactures	-13.6	-19.9	-15.5	-15.9	-14.1
Heavy manufactures	-4.8	-19.8	-16.1	-17.4	-11.4
Construction	25.0	-28.9	-30.0	-26.0	-16.0
Services	-8.6	-8.0	-7.1	-9.5	-8.5

TABLE 7: Cumulative difference in exports due to financial crisis, China and selected countries, 2020 (%).

	China	Japan	US	EU27	World's total
Crops	-10.2	-27.2	-5.2	-13.1	-8.2
Animals	-9.3	-27.9	-13.1	-16.4	-13.4
Food processing	-21.4	-13.9	-11.0	-13.0	-11.9
Forestry and extraction	-32.6	-3.4	-2.6	-1.3	-9.8
Light manufactures	-19.8	-20.1	-6.8	-16.3	-15.8
Heavy manufactures	-14.2	-23.0	-13.8	-18.2	-13.6
Construction	-22.1	-12.6	-5.3	-17.8	-16.5
Services	-36.2	-15.1	-2.8	-14.3	-12.8

changes in real exports and imports for China and other selected countries. The overall impact of the crisis on exports and imports is driven by investment and the realignment of trade balances resulting from the crisis. China experiences an increase in investment, declining trade balances, and relative appreciation of the real exchange rate, while the US and Europe experience declining investment, increasing trade balances, and a relative depreciation.

Turning to the declines in exports at a more detailed sectoral level in Table 7, we find that relatively strong export declines tend to be associated with the fairly strong output declines noted in Table 6, emphasizing the importance of trade to the sectoral output story. World exports of crops, along with forestry and extraction remain relatively robust; however, strong adverse impacts on exports from sectors such as construction and manufacturing are reflected in significantly reduced global output for these sectors. China's exports fall considerably more than production due to the relative appreciation of the real exchange rate caused by the increase in investment and the decline in the trade balance.

While global trade falls across all sectors, the declines are not uniform across sectors. China's imports fall considerably less than exports, and there are even some cases of increased trade to be found within this overall picture as shown in Table 8. The increases in demand for imports stem from a combination of (a) the rise in prices of domestic goods relative to imports in China, caused by the real appreciation of the RMB, (b) a decline in import prices of food and extraction due to the general decline in returns to land and natural resources, (c) the increase in demand for

TABLE 8: Cumulative difference in 2020 of imports due to financial crisis, China and selected countries (%).

	China	Japan	US	EU27	World's total
Crops	-10.3	-4.0	-7.6	-4.3	-7.2
Animals	-15.9	-1.3	-2.3	-10.3	-10.4
Food processing	0.7	-10.4	-7.7	-11.8	-11.2
Forestry and extraction	-4.3	-13.7	-12.5	-13.9	-11.3
Light manufactures	-9.5	-20.1	-23.7	-19.2	-16.8
Heavy manufactures	-11.4	-11.8	-13.9	-14.7	-12.8
Construction	-5.9	-33.6	-41.7	-26.0	-12.0
Services	6.9	-11.1	-14.8	-13.0	-12.3

TABLE 9: Cumulative difference in selected macroeconomic variable under extended financial crisis relative to financial crisis, China and selected countries, 2020 (% deviation).

	Real GDP, 2020	Investment	Real exports	Real imports
China	-1.6	3.9	-3.7	-1.9
Japan	-1.4	-2.3	7.1	-3.9
US	-1.8	0.0	-1.7	-1.8
EU27	-2.8	-2.5	-3.7	-2.7

construction and the assembly of investment goods in China, and/or (d) the fiscal stimulus packages.

4.1. Extended Financial Crisis. In the second scenario, we model an *extended financial crisis* with more protracted impacts than the first scenario.

Comparing the results of selected indicators for the *ex-extended financial crisis* with the *financial crisis scenario* (Table 9), not surprisingly, we find that the impacts are now more severe. While 2010, real GDP variations from the baseline will be identical to the moderate crisis scenario, by 2020 real GDP has declined further for all economies as indicated in the first column of Table 9. This is primarily due to the improvement in investment being delayed, which in turn delays capital accumulation. The further decline in global GDP and incomes also causes global savings and investment to fall (-3.2 percent relative to the *financial crisis scenario*). The impact on investment differs across countries, implying that there is a further re-allocation of investment, resulting from the more gradual adjustment in expectations. Figure 5 indicates that if the financial crisis is protracted, investment tends to be reallocated towards China during the period of extended crisis to 2015. However, the cumulative increase in investment in China by 2020 is lower under the assumptions of the *extended crisis*.

An examination of the aggregate trade results indicates that exports across every sector decline significantly more under the *extended crisis scenario*, with the total world export volume declining by 3 percent more than the *financial crisis*. These changes in aggregate exports are also reflected in output changes by sector and region. Table 10 indicates that while a similar relative sector pattern exists between the first and second scenarios, almost all sectors experience a more

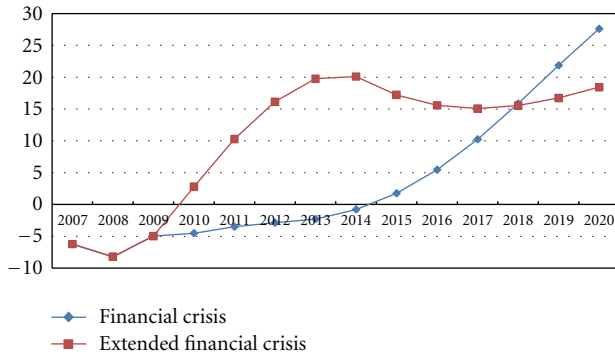


FIGURE 5: Cumulative difference in investment from the baseline, China with *financial crisis* and *extended financial crisis* (%).

TABLE 10: Cumulative difference in output, *extended financial crisis* relative to *financial crisis*, China and selected countries, 2020 (%).

	China	Japan	US	EU27	World's total
Crops	-0.6	-0.4	-1.1	-1.7	-1.6
Animals	-1.0	-1.2	-1.7	-2.6	-2.2
Food processing	-1.6	-1.7	-1.9	-2.5	-2.5
Forestry and extraction	-0.5	-0.8	-1.1	-1.6	-2.1
Light manufactures	-2.5	4.4	-0.9	-3.0	-2.4
Heavy manufactures	-1.6	2.4	-1.5	-3.4	-2.3
Construction	3.6	-2.0	-0.7	-2.6	-2.0
Services	-2.2	-1.8	-1.9	-2.9	-2.8

significant decline in output under the more severe crisis scenario. The exception here is the Chinese construction sector, along with a slight increase in manufactured exports for Japan.

5. Concluding Comments

The global financial crisis continues to have a significant impact on many economies. While the direct impact on the Chinese economy might be considered rather limited, there may be long-run implications, driven in part by changes in investment. In this paper, we used historical data and forecasts in an effort to model the impacts of the crisis within a general equilibrium framework. While the GDyn model used offers a way of modeling how the expected changes in real GDP and investment are likely to work their way through each economy and sector over time, the current study of course has limitations. Of particular note, is that the dynamic CGE model used does not include debt or money obligations; therefore, it does not offer insights into the causes or the total macroeconomic impact of the crisis. We are reliant on other sources for these insights and we note that there have been ongoing modifications to the projections released by international agencies since our modeling was undertaken, with significant uncertainty still remaining in the global economy. A further limitation is that the model used here only incorporates the accumulation of capital; it does not take into account the accumulation

of stocks and in particular the accumulation of natural resources for future use.

Our findings here suggest that the crisis is likely to have a significant effect on trade, due in part to the changes in capital flows resulting from the reallocation of savings across regions. In the short run, all countries including China suffer from the crisis. In the long run, countries such as the US and the EU experience a persistent decline in real GDP, while countries such as China recoup some of the losses. Globally, our results suggest that trade falls by 13.7 percent from the 2020 baseline, and the composition of trade changes quite markedly as a result of the crisis, with shifts reflecting changes in demand for construction of investment goods and the increasing demands of economies such as China. The reallocation of investment towards China is likely to result in eventual gains to China from the crisis, as the higher accumulation of capital leads to higher real GDP, although these are not seen until well after 2020.

A longer-lasting crisis, as modeled in our second scenario, further harms most economies, including China, though with some investment reallocation towards China during the years of the extended crisis in the US and the EU.

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Research Article

Effects of Chinese Economic Stimulus Package on Economic Growth in the Post-Crisis China

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This paper aims to simulate the contribution of investment expansion policy after financial crisis as well as describe the possible economic perspectives in the post-crisis period by using scenario simulation method based on Chinese dynamic economic CGE (computable general equilibrium) model. Energy consumption and CO₂ emission are also considered in order to access the possible negative effects owing to investment enlargement. The results show that expanding investment response to financial crisis increases economic growth rate by 6.74% from 2.36% in 2009. It can relieve the fluctuation in economy and bring the economic growth close to baseline level in the near post-crisis period. However, higher energy consumption intensity and CO₂ emission intensity compared to baseline owing to the increasing investment make energy saving and CO₂ mitigation more difficult.

1. Introduction

The 2008 financial turmoil, started due to the U.S subprime mortgage crisis, brings world economy into a downturn period. Governments even in the rich countries have had to put forward packages to bail out their economy and society. As for China, the central government has also announced a series of macroeconomic policies to alleviate the negative impact from financial crisis, about practicing the “proactive” fiscal and “moderately loose” monetary policies, about taking 10 various approaches to boost domestic consumer demand, and about acceleration the infrastructure construction and so on.

The 4 trillion stimulus package, which scheduled to be implemented in two years with 1.18 trillion Yuan investment planned by the central government and the remaining provided by the local government and nongovernmental, is expected to mainly cover affordable housing projects, infrastructure construction in rural areas, postdisaster reconstruction, improving people’s livelihoods, environmental protection, technological reform and building necessary infrastructure. It is believed that this package plays an important role to maintain a stable and relatively fast growth, with

GDP growth rate achieve 9.6% and 9.1% in 2008 and 2009, respectively.

What is the contribution of such a massive investment to economic growth under financial crisis? What is the economy were look like as if there are no such package policies? What will the economic may appear to be in the near term after financial crisis. To quantitative evaluate the policy effects under and after financial crisis can not only answer the above questions we are concerned about, but also has meaningful reference value for future policy development direction.

It can be seen that China gradually has been becoming a typical investment-oriented economy in recent years. Econometric is the most common method to build the relationship between investment and GDP, including Wu [1], Liu and Yu [2], Wang [3], and Zhang and Hou [4]. These empirical results show that investment plays a significant role in economic growth, while there is a big room for raising the efficiency of investment. Both Wang et al. [5] and Li et al. [6] build multi-regional CGE (computable general equilibrium) model to discuss investment policies on economic development. According to Li et al. [6], the same amount

of investment in different regions deserves different GDP growth, with 200 billion of government investment in eastern, central, and northwestern regions drives total GDP to increase by 0.56%, 1.38%, and 1.54%, respectively.

A few studies have qualitatively investigated the very likely effects and correlative problems associated with Chinese stimulus package (Ding [7], S. L. Zhang [8], X. P. Zhang [9]). With regard to empirical analysis, Wang and Lu [10] used the national income multiplier theory and pointed out that the 4 trillion investment stimulate policy can achieve the desired effects with the rapid recovery of world economy. It can stabilize the society and economy in the short run, while is less favorable to optimize economic growth pattern. Based on a static multi-regional CGE model analysis, GDP growth rate and employment tend to be higher if investing to central China compared to the whole country or western China (Sun et al. [11]).

This paper aims to simulate the contribution of investment expansion policy to Chinese economic growth by using scenario simulation method based on Chinese dynamic economic CGE model. Moreover, it takes the advantage of dynamic CGE model and attempts to describe the possible economic perspectives in post-crisis period under different scenarios. Furthermore, in contrast with other previous research, allowing for the possible problems of over capacity due to large investment, this study assesses the influence on energy consumption and CO₂ emission from enlarging investment.

The rest of the paper is organized as follows: methodology and data are described in Section 2. Section 3 presents the setup of three scenarios considered in the simulation. The results under different scenarios are outlined in Section 4. It is followed by a conclusion in Section 5.

2. Methodology and Data

2.1. Methodology

2.1.1. Production Structure of CGE Model. CGE model, which is not only good at describing microeconomic optimization behaviors and mutual relationship among different economic agents, but also analyzing the macroeconomic consequences caused by policy change, has become an effective tool for policy simulation.

The basic dynamic CGE model is built based on the structure from Lofgren's work [12]. In order to assess the policy impact on energy consumption and CO₂ emission, energy is treated as production factor and embedded into production module, which refers to the work of Wu and Xuan [13]. Hence, the input of production can be divided into three factors of capital, labor, and energy as well as nonenergy intermediate commodities (1).

$$Y_i = f_i(A_i, K_i, L_i, E_i, V_i), \quad (1)$$

where, Y_i denotes output of sector i , A_i denotes shift parameter of sector i , and K_i L_i E_i V_i is the input of capital, labor, energy, and intermediate commodities to sector i , respectively.

Since the elasticity of substitution varies among different input, the production is described by multilevel nested structure. Intermediate commodities enter into the model with Leontief structure (2) to reflect the assumption of no substitution among different intermediate commodities as well as between intermediate commodities bundle and factors bundle. The labor-capital-energy bundle derives from a multilevel CES (constant elasticity of substitution) structure (3) among labor, capital and energy. Similarly, energy enters into the model with a multilevel nested structure of the 9 type energy, which including coal, oil, natural gas, oil refined products, coke, fuel gas, thermal electricity, other electricity, and heat. The framework of production module is shown in Figure 1

$$\text{Leontief function: } Y_i = \min(\alpha * X_{i1}, \beta * X_{i2}), \quad (2)$$

$$\begin{aligned} \text{CES function: } Y_i &= f(X_{i1}, X_{i2}) \\ &= (\alpha * X_{i1}^\rho + \beta * X_{i2}^\rho)^{1/\rho} \\ &= A * (\alpha * X_{i1}^\rho + (1 - \alpha) * X_{i2}^\rho)^{1/\rho}, \end{aligned} \quad (3)$$

where, α denotes share parameter of input X_{i1} , β denotes share parameter of input X_{i2} , and ρ denotes substitution parameter.

2.1.2. Other Modules. Economic growth is driven by investment, consumption and net export. Investment is determined by saving which come from household, government, enterprise, and abroad. Household income is used for tax payment, consumption and saving, while government income is expended for transfer payment, subsidy, consumption, and saving. Household and government consumption are codetermined by income and consumption preference, and they are described through the extended linear expenditure system. The Armington assumption is used to distinguish identical domestic goods and imported (exported) goods. World price is exogenous and China is treated as price taker.

It is assumed that returns to scale of all sectors are constant, and the proportion of effective labor force to total population is constant in the simulation period. The modeling of dynamism is realized by capital accumulation, labor growth, and technological improvement. The simulation period is from 2007 to 2015.

2.2. Data. The basic dataset of this model is China 2007 SAM (Social Accounting Matrix), which is constructed using the 2007 135-sectors input-output table and other data in 2007 including custom, tax, international balance of payment, together with flow of funds. The 135-sectors input-output table is aggregated and disaggregated into 39 sectors, which includes 1 agriculture sector, 36 industry sectors and 2 service sectors.

Substitution elasticity among different energy, energy and capital, energy-capital combination, and labor refers to the research of Wu and Xuan [13] and MIT-EPPA [14]

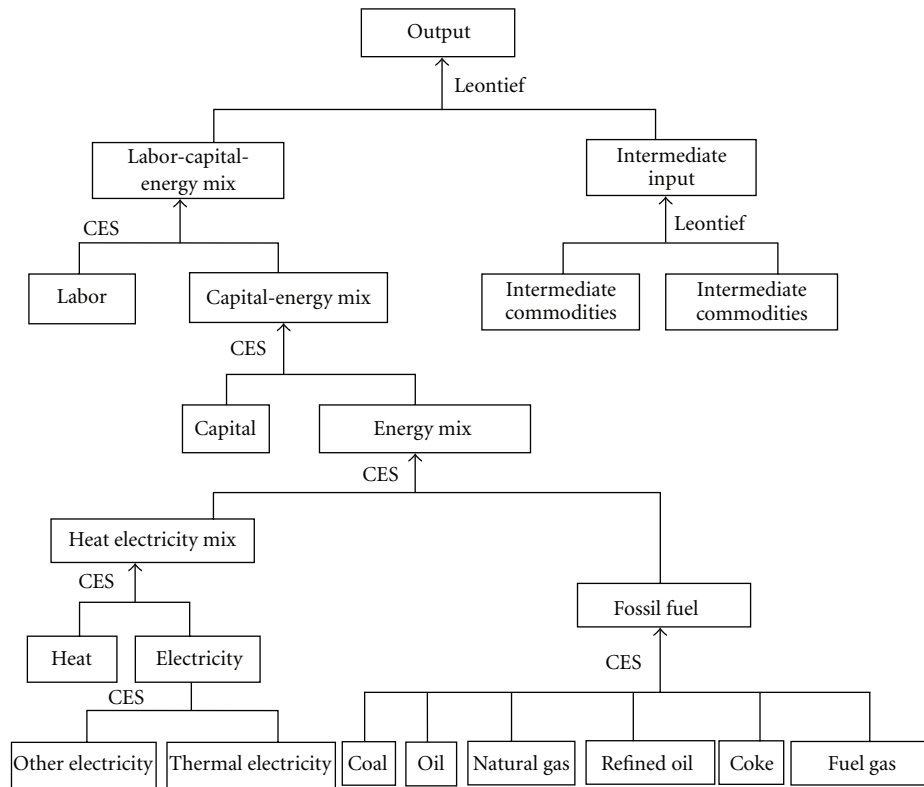


FIGURE 1: Structure of production module in dynamic CGE model.

Substitution elasticity between import and domestic commodities refers to GTAP-6. The data of labor by sectors come from “Fifth Population Census” and “China Economic Census Yearbook 2004”. The data of fixed assets investment and population are from “Chinese Statistical Yearbook 2008”.

Energy consumption should be treated in physical terms, while the input-output table provides energy consumption in each agent in monetary terms. The base year conversion coefficients (regarded as energy price) can be got from dividing monetary terms to physical terms (China Energy Statistics Yearbook, 2008), which are also used in the forecast of future energy consumption from CGE model. CO₂ emissions can be calculated by the method recommended by the IPCC [15]. That is, multiplying each type of fossil fuel consumption with its CO₂ emission factors and oxidation rate. Hence, this paper only covers the CO₂ emission from fossil fuel.

3. Scenario Design

Using the methodology described above, three scenarios have been designed to illustrate the potential economic effects of stimulate packages: the first scenario is a baseline scenario, where it is to describe the Chinese normal economic development trajectory without financial crisis. The second scenario, that is, crisis scenario, shows the economic growth path under crisis without carrying out corresponding policies. The third scenario is the policy scenario that portrays economic growth pathway with implementing positive activ-

ities (mainly focus on investment stimulus package) after financial turmoil. Some key parameters are set as follows.

3.1. Baseline Scenario. Besides the parameters which can be calibrated according to the base year data and the elasticity of substitution, annual labor supply, and TFP (total factor productivity) growth rate are exogenous in this model. The existing research show that TFP growth rates mainly distribute in the range of 2% to 4% over the past three decades. TFP annual growth rate is estimated by 3.14% from 1981 to 2002 (Sun and Ren [16]), and 3.63% during the period of 1999–2007 (Wang et al. [17]). It is assumed that TFP will not always keep a high level and gradually decline, with a growth rate of 3.2% in 2008–2010 and 2.8% from 2011 to 2015.

Commodity price index consumed by household and government refers to CPI historical data. Average value of CPI from 1990–2010 is 104.8 and 102.4 when eliminating the outlier value and here is expected to an average value of 103 during the simulation time. What is more, it is assumed that the proportion of effective labor force to total population is constant in the simulation period.

3.2. Crisis Scenario. The impacts on import and export, as well as productivity due to financial crisis are taken into consideration under crisis scenario. The import-export trade is shocked greatly by the decline of overseas demand and import-export commodities price from the end of 2008. Export price is supposed to drop by 5% in 2008 and 15%

in 2009, together with an assumed reduction rate of 5% in 2008-2009 for import price. The import and export price are expected to return to the level of 2007 from 2010.

It is supposed that the growth rate of gross fixed capital formation is in line with baseline scenario, with an absolute value of 10.54 trillion, 12.82 trillion and 19.4 trillion Yuan in 2007, 2009, and 2015, respectively. Commodity price index consumed by household and government is influenced by investment and becomes endogenous under crisis scenario.

Some labor forces and capitals are laid aside result in a decline of TFP under financial crisis. The prediction by Wang et al. [17] suggests that TFP growth rate is likely to drop to 1.79% in 2008–2020 with financial crisis. Hence, TFP growth rate is assumed to 1.8% in 2009 and gradually restore to the baseline level in 2011.

3.3. Policy Scenario. Policy scenario is aiming to assess the effects of the enlarging investment policy after financial crisis. Actual value of gross fixed capital formation is calculated based on its contribution to GDP in 2008 and 2009. In 2009, the added investment was 5.2 trillion Yuan and the actual fixed capital formation was 2.5 trillion Yuan. From 2010, the growth rate of fixed capital formation is similar with baseline. TFP growth rate is calibrated to 3.1% and 2.5% by the real GDP in 2008 and 2009 and supposed to be the same with baseline from 2010. It should be noticed that investment brings a part of inactive labors and capitals back to work again and drives TFP to become higher compared to crisis scenario.

4. Results

4.1. Economic Effects in Different Scenarios

4.1.1. GDP. GDP is predicted to grow from 27.2 trillion Yuan in 2007 to 52.5, 47.8, and 51.6 trillion Yuan (based on 2007 price) in 2015 under baseline scenario, crisis scenario and policy scenario, respectively (Figure 2). GDP growth rate falls to 2.36% in 2009 without any corresponding policies affected by financial crisis. It follows by a strong rebound in 2010 and then appears a little lower than baseline. Expanding investment is one of a primary impetus behind economic recovery. It stimulates GDP growth rate up to 9.10% in 2009 compared to 2.36% in crisis scenario. The results show that the average annual GDP growth rates during the period of “Chinese twelfth five years plan”, that is, from 2011 to 2015, are 7.94%, 7.38%, and 7.61% under baseline scenario, crisis scenario, and policy scenario, respectively. Although GDP growth rate in policy scenario is below baseline from 2011, the gap is becoming smaller and smaller with years roll on (Figure 3). It can be observed that investment can alleviate the great impact on GDP growth and relieve the fluctuation in economy owing to the sharp decrease of overseas demand as well as bring the economic growth into baseline level in the near term gradually.

4.1.2. Import and Export. Figures 4, 5, 6, and 7 display the change of import and export under different scenarios. The annual growth rate of total export in constant price is

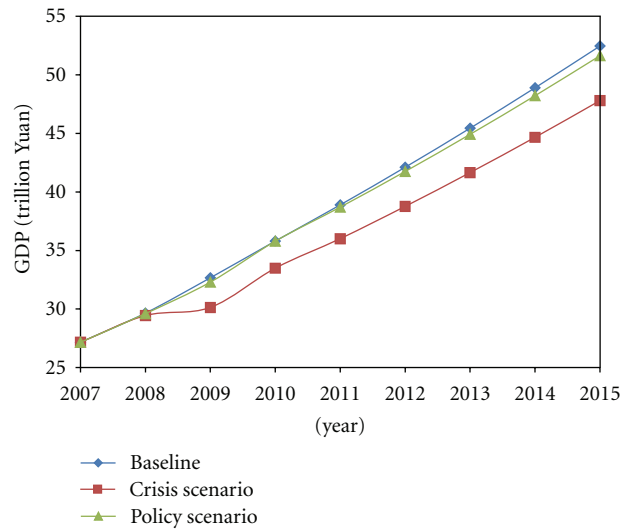


FIGURE 2: GDP in different scenarios.

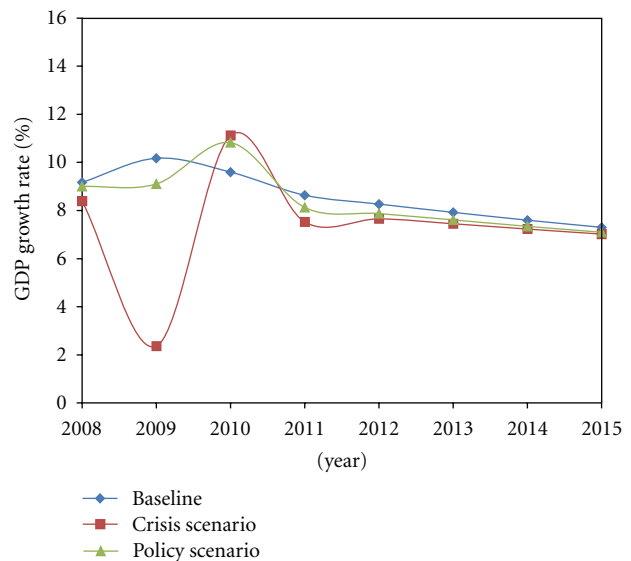


FIGURE 3: GDP growth rate in different scenarios.

approximately 6.2%–7.5%, while the total import increases less quickly with an annual growth rate of 5.8%–7.5% during the period of 2008–2015 under baseline. Owing to the impact of financial crisis, total export starts to decline from 2008, together with total import and total export experience a sharp slowdown in 2009. The results show that the total export and total import fall by 19.6% and 5.7% in 2009, respectively. Whereas they increase rapidly in 2010 with a growth rate of 33.0% for total export and 21.7% for total import from the very low level in 2009 and then following by a steady ascent from 2011. Investment plays an important role in stimulating domestic demand but has a limited influence on international market. Hence, total export and total import also appear negative growth with a drop rate by 17.1% and 5.3% in 2009 compared to 2008, which means that the effects on preventing the decrease of export and

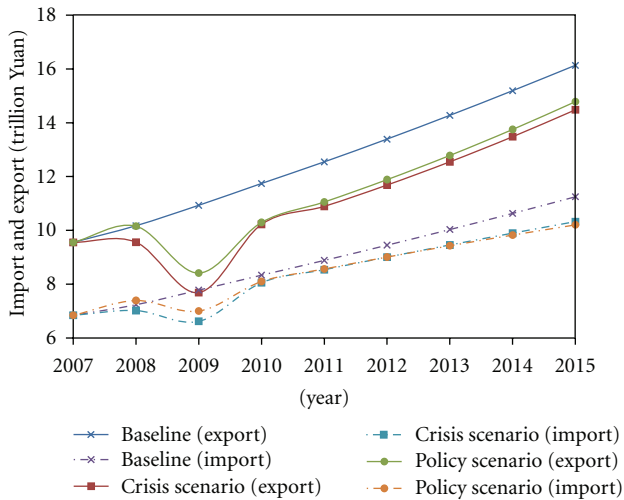


FIGURE 4: Import and export in different scenarios.

import are small with the policy of enlarging investment. Similar to crisis scenario, total import and total export begin to rebound and rise quickly in 2010 and then tend to increase steady from 2011. Although the growth rate of total export under crisis scenario and policy scenario are higher than baseline, the absolute amount appear 1-2 trillion Yuan lower during the period of 2011–2015.

Under baseline scenario, total net export keeps increasing from 2.71 trillion Yuan in 2007 to 4.88 trillion Yuan in 2015, while the growth rate goes to decline gradually as time passes by, which decreases from 8.2% in 2008 to 7.1% in 2015. Net export decreases significantly in 2009 under crisis scenario and policy scenario, while it starts to increase close to the baseline level after financial crisis. With investment policy, net export raises a little bit faster compared to crisis scenario. Similar to the tendency of total export, net export grows much faster from the very low level in 2009 under crisis scenario and policy scenario compared to baseline in post-crisis period. Whereas the absolute amount are 0.7 trillion and 0.3 trillion Yuan lower than baseline in 2015, respectively.

The above results demonstrate that although investment policy stimulates the economic development greatly, it has limited impact on import and export. Tables 1 and 2 display the changes of import and export quantity in import or export intensive sectors in 2009 and 2015 under policy scenario.

In comparison with baseline, export quantities of most export intensive sectors drop by over 15% in 2009, especially in Instruments Meters Cultural and Office Machinery sector, Electric Equipment and Machinery, Electronic and Telecommunication Equipment sector, and Textile Industry sector, whose reduction rate achieve more than 18%. As time goes on, export quantities in different sectors gradually tend to approach the baseline level, and the export change rate in policy scenario compared to baseline are mainly concentrated around -8% in 2015.

Import quantities of most import intensive sectors are near or over 10% lower than baseline level in 2009, among

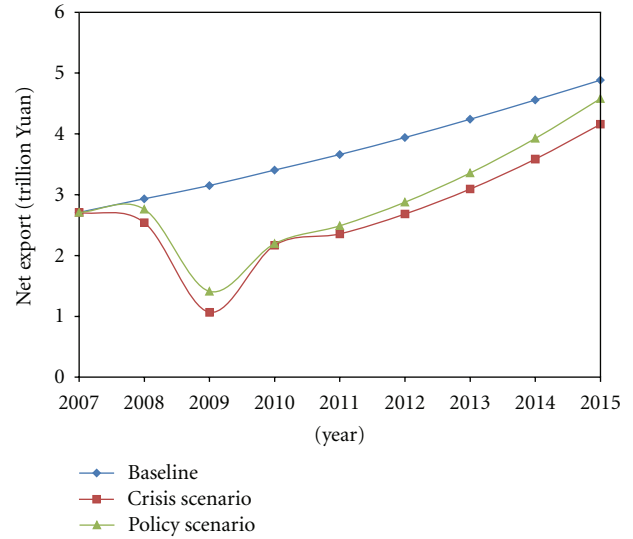


FIGURE 5: Net export in different scenarios.

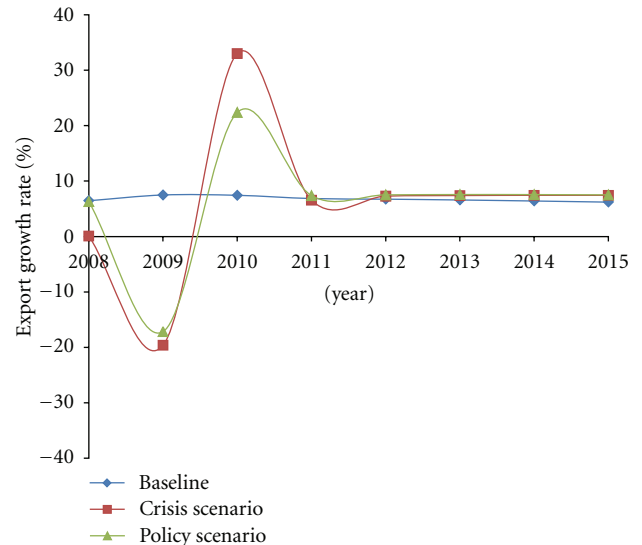


FIGURE 6: Export growth rate in different scenarios.

which, energy extraction sectors are affected relatively more seriously. The differences of import quantities between policy scenario and baseline scenario in most import intensive sectors tend to decrease through time.

4.1.3. Consumption and Income. It appears that the variation of final consumption growth rate among three scenarios is less radical compared with net export and GDP growth rate. In the scenario of baseline, total final consumption grows from 13.2 trillion Yuan in 2007 to 27.2 trillion Yuan in 2015 (Figure 8). It experiences a highest increase in 2009, with a growth rate of 11.3% in 2009, and then falls to 8.5% in 2015. Final consumption growth rate drops to 6.85% in 2009 due to the financial crisis. Whereas it rebounds to increase to 7.56% in 2012 and declines to 6.63% in 2015. Boosted by the increased investment under policy scenario, the annual

TABLE 1: Export change rate of sectors in policy scenario compared to baseline.

Sectors	Export change rate (%)	
	2009	2015
Electric equipment and machinery, electronic and telecommunication equipment	-18.8	-8.2
Other services	-14.9	-8.6
Textile industry	-18.8	-8.8
General and special-purpose machinery manufacturing	-13.8	-7.7
Manufacture of clothes, leather, fur, feather and its products	-16.2	-9.8
Transport, storage, and postal telecommunication service	-14.7	-7.3
Smelting and pressing of ferrous metals	-14.0	-8.1
Metal products	-15.2	-8.2
Raw chemical materials and products	-15.3	-8.1
Transportation equipment	-13.5	-8.3
Instruments meters cultural and office machinery	-25.1	-8.0
Rubber products plastic products	-15.8	-8.2
Timber processing, bamboo, cane, palm, straw products, and furniture	-15.5	-8.0
Printing, recording media reproduction, stationery, education and sports goods	-15.7	-9.0
Manufacture of foods and beverage	-14.0	-10.8

Note: the above 15 sectors account for 91.5% of total export in 2007, and size down according to the share of export.

TABLE 2: Import change rate of sectors in policy scenario compared to baseline.

Sectors	Import change rate (%)	
	2009	2015
Electric equipment and machinery, electronic and telecommunication equipment	-8.7	-8.6
Raw chemical materials and products	-15.4	-9.6
General and special-purpose machinery manufacturing	-3.7	-6.5
Other services	-5.7	-14.7
Crude oil extraction	-14.2	-9.4
Instruments meters cultural and office machinery	-5.1	-8.5
Manufacture of transport equipment	-5.1	-8.9
Ferrous metals mining and dressing	-10.1	-7.2
Nonferrous metals mining and dressing	-13.6	-7.5
Agriculture	-9.8	-11.7
Smelting and pressing of ferrous metals	-11.5	-8.1
Other machinery industry	-12.7	-6.5
Manufacture of foods and beverage	-9.3	-13.9
Natural gas extraction	-16.2	-8.8
Processing of petroleum and nucleus fuel	-11.6	-9.3

Note: the above 15 sectors account for 88.8% of total export in 2007 and size down according to the share of import.

growth rate of final consumption mainly distribute to the interval between 1.5% and 2% higher than crisis scenario and 1% lower than baseline.

The results show a similar change tendency of government income and household income (Figures 9 and 10). They both have an upward trend but a reduced growth rate till 2015 under baseline. Government income starts from 7.8 trillion Yuan in 2007 and then grows at an average annual rate of 10.4% to 17.2 trillion Yuan in 2015. Rural household income and urban household income are from 4.1 trillion Yuan and 13.3 trillion Yuan in 2007 to 12.4 trillion Yuan and 34.1 trillion Yuan in 2015, with an average growth rate of 14.9% and 12.5%, respectively.

Government income and household income appear negative growth in 2009 affected by financial crisis. They decrease by 4.4% of government income, as well as 2% and 5.3% of rural household income and urban household income, which means a more significant impact on urban household than rural household. The growth rate of government income, rural household income, and urban household income are tending stability but a little lower than baseline after a bounce in 2010, with an average annual growth rate of 8.96%, 12.36%, and 10.73% during 2011–2015. Stimulated by investment in 2009, government income, rural household income and urban household income rise at a certain extent and then grow as the similar tendency as baseline and crisis

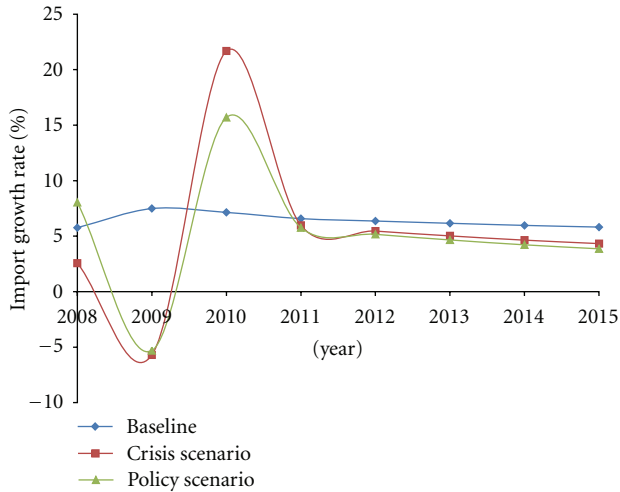


FIGURE 7: Import growth rate in different scenarios.

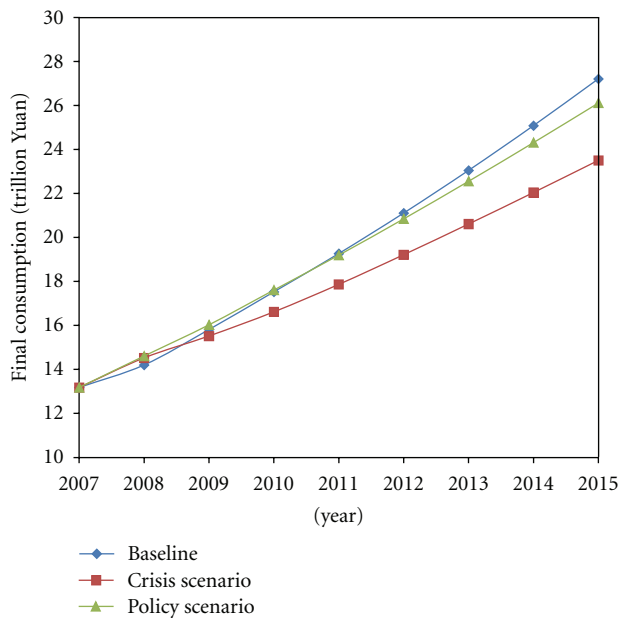


FIGURE 8: Final consumption in different scenarios.

scenario, which increase with an average annual rate of 8.92%, 12.66%, and 10.70% from 2011 to 2015, respectively.

4.1.4. GDP Composition. The predicted results show that the share of final consumption in GDP is getting higher, while net export and gross fixed capital formation account for a decreasing proportion with years roll on under baseline scenario (Table 3). Contrast with the decreasing contribution rate of gross fixed capital formation, the contributions from final consumption and net export to GDP growth tend to increase recently in baseline scenario. The proportional of net export to GDP resulted from financial crisis is simulated to reduce rapidly by 6 points of percentage compared with baseline in 2009. The share of gross fixed capital formation to GDP with investment enlarging policy is 4% higher than

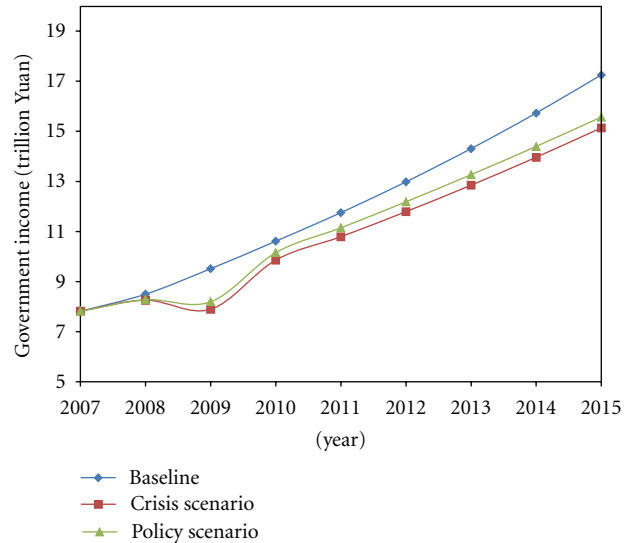


FIGURE 9: Government income in different scenarios.

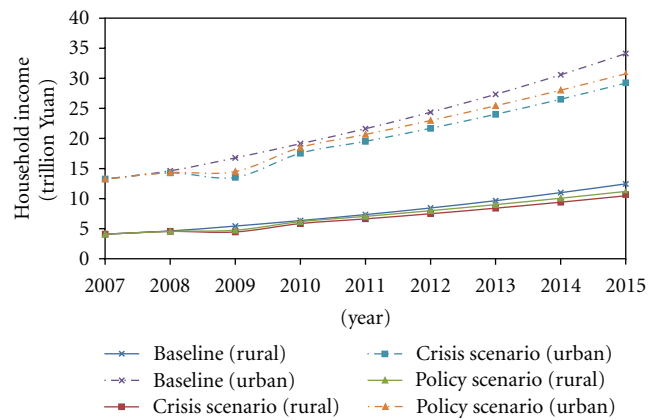


FIGURE 10: Household income under different scenarios.

baseline in 2009. Gross fixed capital formation increment accounts for 92.3% of GDP growth, while the net export experiences a negative contribution of -44.9% to GDP growth (Table 4). It can be identified that GDP growth is primary driving by investment under policy scenario.

Despite the net export account for lower share of GDP under crisis scenario and policy scenario compared to baseline, the contributions to GDP growth from incremental net export tend to be higher with the gradual recovery of import and export through time. Investment increasing policy stimulates consumption and leads to a larger contribution from final consumption to GDP growth in comparison with crisis scenario in the near post-crisis term.

Table 5 displays some comparisons between the actual data and simulation results. It can be identified that the results under policy scenario are similar with the actual data in 2009. The actual data illustrate again that stimulus package played a significant role in stabilizing economic growth. However, there are some differences between the results under policy scenarios and the actual data in 2010.

TABLE 3: GDP composition by expenditure approach in different scenarios (%).

		2007	2009	2011	2013	2015
Baseline	Final consumption	48.5	48.4	49.5	50.7	51.9
	Gross fixed capital formation	41.5	42.0	41.1	40.0	38.8
	Net export	10.0	9.6	9.4	9.3	9.3
Crisis scenario	Final consumption	48.5	51.5	49.6	49.5	49.2
	Gross fixed capital formation	41.5	45.0	43.9	43.1	42.1
	Net export	10.0	3.5	6.5	7.4	8.7
Policy scenario	Final consumption	48.5	49.6	49.6	50.2	50.6
	Gross fixed capital formation	41.5	46.0	44.0	42.3	40.6
	Net export	10.0	4.4	6.4	7.5	8.9

TABLE 4: Contribution to GDP growth in different scenarios (%).

		2009	2011	2013	2015
Baseline	Final consumption	53.4	56.3	58.2	59.6
	Gross fixed capital formation	39.4	35.4	32.8	31.2
	Net export	7.2	8.3	9.0	9.1
Crisis scenario	Final consumption	143.1	49.6	48.3	46.6
	Gross fixed capital formation	168.8	43.0	37.4	35.1
	Net export	-211.9	7.5	14.2	18.3
Policy scenario	Final consumption	52.7	54.5	53.8	52.7
	Gross fixed capital formation	92.3	35.4	31.1	28.2
	Net export	-44.9	10.1	15.1	19.1

Compared with the actual data, the contribution to GDP growth from gross fixed capital formation is lower, while the contribution from net export and final consumption appear higher under policy scenario. The main reason is time lag of stimulus policy effects. Due to ongoing projects need to be supported by subsequent investment, a big scale of credit funds (7.5 trillion Yuan) was input into the economy in 2010. It leads to relatively higher contribution to GDP of fixed capital formation in 2010. However, the shock from stimulus policy is only imposed in 2009 under policy scenario. The simulation did not take consideration of the impacts of subsequent credit funds impact on gross fixed capital formation in 2010. Moreover, the influence of the appreciation of RMB on import and export is not captured in this work.

4.2. Energy Consumption and CO₂ Emission in Different Scenarios. The dynamic CGE model is also applied to explore the impact of expanding investment on energy saving and CO₂ mitigation. The predicted total energy consumption are 4.25, 4.02, and 4.26 Gtce, as well as total CO₂ emission are 8.37, 8.02, and 8.42 Gt in 2015 under baseline, crisis scenario and policy scenario, respectively (Figures 11 and 12). Among which, high energy intensive sectors, including Production and Supply of Thermal Power Generation and Heat, Smelting and Pressing of Ferrous Metals, Transport, Storage, and Postal Telecommunication Service, Raw Chemical Materials and Products, Manufacturing of Cement, Lime and Plaster, Construction, Processing of Petroleum and Nucleus Fuel, Manufacture of Nonmetallic Mineral Products, account for approximately 82% in total CO₂ emission (Table 6).

Figures 13 and 14 display the energy consumption intensity and CO₂ emission intensity under different scenarios. Both energy intensity and CO₂ intensity appear a gradual decline along with the time due to the growth of TFP, but the variations exist among different scenarios. Under baseline scenario, energy consumption per unit GDP is decrease by 13.2%, from 0.93 tce/10000 Yuan in 2007 to 0.81 tce/10000 Yuan in 2015. In the meanwhile, CO₂ emission per unit GDP is from 2.02 t/10000 Yuan in 2007 to 1.59 t/10000 Yuan in 2015, with a drop rate by 21.2%. Owing to the low productivity, energy consumption intensity and CO₂ emission intensity appear to increase in 2009 under financial crisis, and then falling to 0.84 and 1.68 in 2015, which are 3.9% and 5.2% higher than baseline, respectively. Energy consumption intensity and CO₂ emission intensity with investment policy are also above the level of baseline. The results show the energy consumption intensity and CO₂ emission intensity are 0.83 tce/10000 Yuan and 1.63 t/10000 Yuan in 2015, which are 1.9% and 2.3% higher than baseline.

It can be identified that relying on the policy of increasing investment response to financial crisis brings a higher energy consumption intensity and CO₂ emission intensity compared to baseline, which enhances the difficulty for energy saving and CO₂ mitigation.

Actually, energy intensity has reduced 19.1% during the period from 2005 to 2010. It should be noticed that simulations in this paper do not reflect the real condition with all energy saving policies but only aim to assess the effects on energy and CO₂ emission due to expanding investment policy. In the period of “Chinese twelfth five year plan”

TABLE 5: Comparison between the actual data and simulation results (%).

		Actual data	Baseline	Crisis scenario	Policy scenario
2009	GDP growth rate	9.1	10.2	2.4	9.1
	Final consumption	48.6	48.4	51.5	49.6
	GDP composition				
	Gross fixed capital formation	46.7	42.0	45.0	46.0
	Net export	4.7	9.6	3.5	4.4
	Final consumption	45.4	53.4	143.1	52.7
Contribution to GDP growth	Gross fixed capital formation	95.2	39.4	168.8	92.3
	Net export	-40.6	7.2	-211.9	-44.9
2010	GDP growth rate	10.3	9.6	11.1	10.8
	Final consumption	47.6	48.9	49.6	49.2
	GDP composition				
	Gross fixed capital formation	47.5	41.6	43.9	44.7
	Net export	4.9	9.5	6.5	6.1
	Final consumption	37.3	54.7	32.8	45.3
Contribution to GDP growth	Gross fixed capital formation	54.8	37.2	34.4	32.3
	Net export	7.9	8.1	32.9	22.4

Source: the actual data come from: <http://www.stats.gov.cn/>.

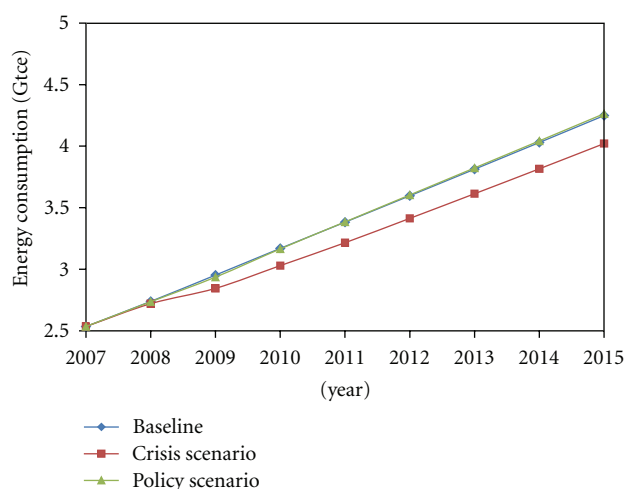
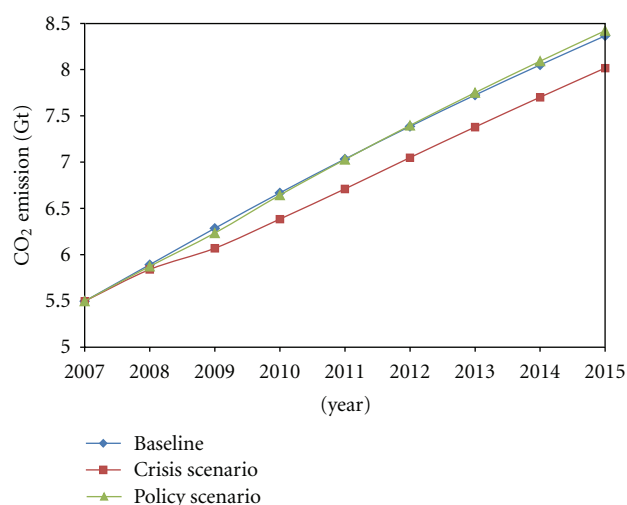


FIGURE 11: Energy consumption in different scenarios.

FIGURE 12: CO₂ emission in different scenarios.

(from 2011 to 2015), the simulated CO₂ emission intensity are forecasted to fall by 11.8%, 10.0%, and 10.2% under baseline scenario, crisis scenario and policy scenario, respectively, which imply that Chinese government should adopt additional CO₂ mitigation policies under the pressure of CO₂ intensity target towards 2020.

5. Conclusions

This paper constructs a Chinese dynamic CGE model to get the possible near term economic development pathways under different scenarios, and assess the contribution of investment expansion policy to Chinese economic growth. Moreover, taking into account the possible problems of over capacity owing to enlarging investment, energy consumption, and CO₂ emission are also compared among different scenarios.

The results show that GDP growth rate falls to 2.36% in 2009 without any corresponding policies due to a sharp decrease of export and import as well as productivity affected by financial crisis. The policy of expanding investment can significantly alleviate the great impact on GDP growth and relieve the fluctuation in economy. It can increase economic growth rate by 6.74% to 9.10% in 2009, among which, the gross fixed capital formation plays an important role in GDP growth. A higher TFP, together with final consumption and net export, is driving by investment. Moreover, it can also alleviate the range of variations about the growth rate of consumer and government income as well as final consumption.

Actually, the newly added investment in 2009 was 5.2 trillion Yuan, including part from the natural growth under business as usual, and part from stimulus policies respond to financial crisis. The average annual growth rate for total

TABLE 6: CO₂ emission in high energy intensive sectors in 2015 (Gt).

	Baseline	Crisis scenario	Policy scenario
Production and Supply of Thermal Power Generation	3.42	3.3	3.45
Smelting and Pressing of Ferrous Metals	1.32	1.3	1.34
Transport, Storage, and Postal Telecommunication Service	0.72	0.68	0.73
Raw Chemical Materials and Products	0.41	0.4	0.42
Manufacturing of Cement, Lime, and Plaster	0.34	0.35	0.35
Production and Supply of Heat	0.3	0.29	0.3
Construction	0.11	0.11	0.11
Processing of Petroleum and Nucleus Fuel	0.11	0.1	0.11
Manufacture of Nonmetallic Mineral Products	0.1	0.1	0.11
<i>Subtotal</i>	6.85	6.62	6.92
<i>Share in total emission (%)</i>	81.8	82.6	82.2

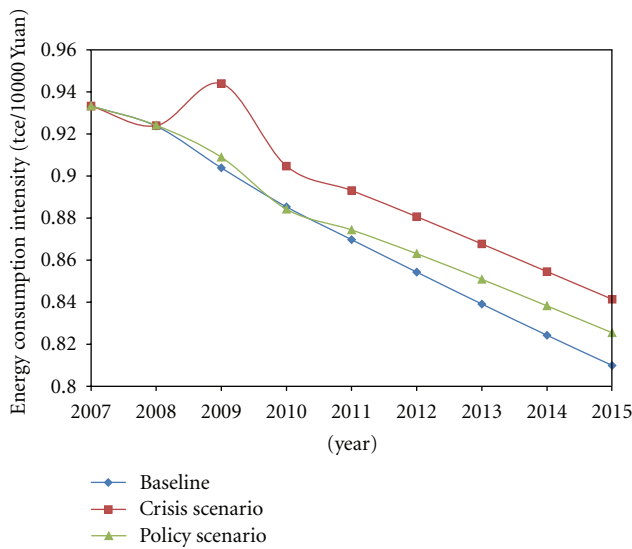
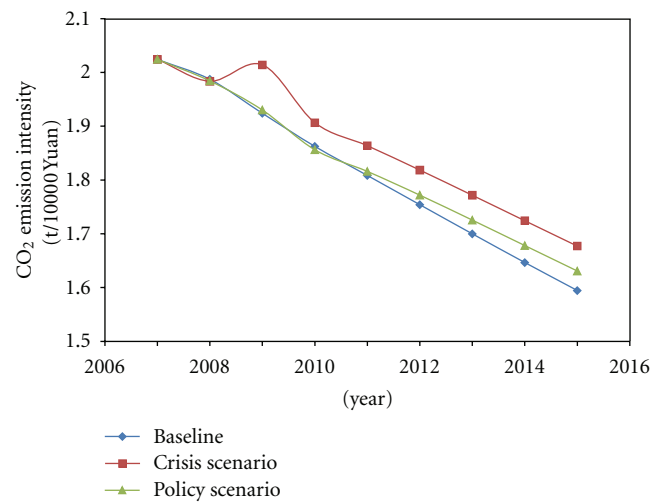


FIGURE 13: Energy intensity in different scenarios.

investment in fixed assets was 20.6% from 2000 to 2008, among which 15.7% for 2000–2003 and 25.5% for 2004–2008. Affected by financial crisis, natural growth of investment in 2009 seemed lower than the period of overheated economy without economic stimulated plan. Whereas allowing for inertia of economic activity, the natural growth rate of investment in 2009 was postulated as 18%. The difference between the actual investment and investment with natural growth can be treated as incremental investment owing to stimulated policies. Gross fixed capital formation increased 2.5 trillion Yuan from 2008 to 2009, among which, 1.3 trillion Yuan was deserved from the incremental investment. The total gross fixed capital formation accounted for 92.3% to GDP growth in 2009.

The investment enlargement policy brings the economic growth close to baseline level gradually in the near post-crisis period, with an average GDP annual growth rate of 7.94%, 7.38%, and 7.61% under baseline scenario, crisis scenario, and policy scenario, respectively. Net export is also toward the baseline level through time with policy. Although the

FIGURE 14: CO₂ emission intensity in different scenarios.

net export account for lower share of GDP under crisis scenario and policy scenario versus baseline, the contribution to GDP growth from incremental net export tend to be higher with the gradual recovery of import and export. Final consumption keeps growing but with a decreasing growth rate as time passes by. The expanding investment stimulates the annual growth rate of final consumption to be 1.5%–2% higher than crisis scenario but 1% lower than baseline, and it leads a larger contribution from final consumption to GDP growth in comparison with crisis scenario in near term.

However, the increasing investment policy also brings new problems. It induces higher energy consumption intensity and CO₂ emission intensity, which are 1.9% and 2.3% more than baseline in 2015, respectively. It can be observed that the investment enlarging policy enhances the difficulty for energy saving and CO₂ mitigation.

It should be noticed that this paper focuses on the effects of expanding investment policy on economic growth but not put attention to the impacts of monetary policy on macroeconomic consequences. In fact, the moderately loose monetary policy has led to a huge increase in loan. It is thought that excessive fluidity has posed impacts on inflation

in post-crisis China. The analysis on such issue is not involved in this paper.

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