

## **Chinese Economy under International Financial Turmoil -----Recent Development, Policy Response and Rebalancing Approach<sup>12</sup>**

**Abstract:** In this paper, we review the impacts of global financial crisis on Chinese economy and introduce what policy measure have been adopted by Chinese government to fight against the crisis. Thanks to those stimulus policies, Chinese economy witnessed better than expected recovery in the short run. Nevertheless, sustainable growth is still a question. It depends on how successful could China shift resources from tradable to nontradable sector, which requires fundamental changes of China's development strategy.

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# I Introduction

Chinese economy witnessed dramatic fluctuations from second half of 2008. Global financial turmoil, together with cyclical downward adjustment which was started in the end of 2007, resulted in extreme inventory and production reduction in the fourth quarter of 2008. The magnitude of slowdown in real economy is far beyond most economists' expectation and attracted policy maker's high attentions. Plenty of stimulus policies were adopted in a very short time period to avoid further slowdown of the real economy. In the first quarter of 2009, Chinese Economy witnessed better-than-expected recovery. In contrast to many financial institutions in the rest world threatened by bankruptcy and therefore are forced to make deleveraging, Chinese commercial banks, which are dominate players in China's financial market, are running healthy balance sheet and increase their loans by more than 20% in the first quarter of 2009. In contrast to asset price downturn and dramatic currency depreciation in some emerging market economies, China's composite share index begun to rebound by more than 20% in the first quarter of 2009 and international confidence for RMB is strong. In contrast to global real economy downturn, China's industrial sector has seen more and more indicators, such as PMI, electricity production, are on the upturn.

Does this mean that Chinese economy has gone through global financial and economic crisis? We are trying to put question into details: What are the impacts of international financial turmoil on Chinese economy? What policy responses were adopted by the government and how to evaluate the effectiveness of those policies? What should China learn from this international financial turmoil and what further policy changes should be implemented to rebalance China's economic growth?

The following content are organized as follows: part II evaluate the impacts of international financial turmoil on Chinese economy; part III introduce Chinese government's policy responses and evaluate the effectiveness of those polices; part IV draw lessons from international financial crisis and propose our views on China's rebalancing strategy.

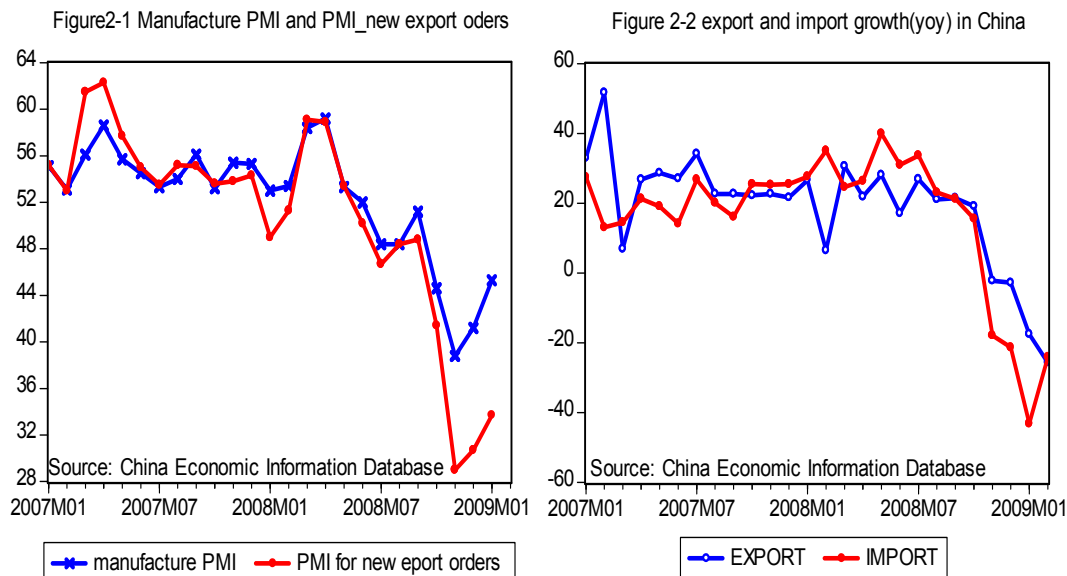
## II Impact of International Financial Turmoil on Chinese economy

Impact of international financial turmoil was mainly concentrated in real sector of Chinese economy. In the fourth quarter of 2008, Chinese economy witnessed unexpected collapse in industrial sector and approximately 20 million rural migrant workers losing jobs, which were caused by international financial turmoil as well as domestic factors. When it comes to the first quarter of 2009, in spite of export and import growth plunging at double digit rate, overall economic activity see weak

positive changes. Fortunately, due to limited involvement of China's private sector in oversea financial market, Chinese financial institutions, household, enterprise and government are generally in healthy conditions and domestic financial market is still working.

## Real variables

Tradable sector are severely affected by external demand shock. Manufacture PMI and PMI for new export orders begun to turning into below 50% from July of 2008 and continued to decline until November of 2008 with Manufacture PMI 33.8% and PMI for new export orders 29%. Import and export growth turned into negative from November of 2008 and continued to decline sharply in the first quarter of 2009. Confronted with more than expected worsening of external market, most export related enterprises made dramatic actions in consuming inventories, depressing production and suspending new capacity building, tens of thousands enterprises announced bankruptcies and tens of millions migrant workers lost jobs.



Slowdown of investment growth in real estate sector accelerated economic slowdown. In addition to worsening of external demand, investment growth in domestic real estate sector, which was used to be another major growth engine and started its cyclical downward adjustment from middle of 2008 in response to macro policy tightening, dropped from 30% at the middle of 2008 to 20% at end of 2008,

Figure 2-3 Fixed Asset investment and Real Estate Investment growth

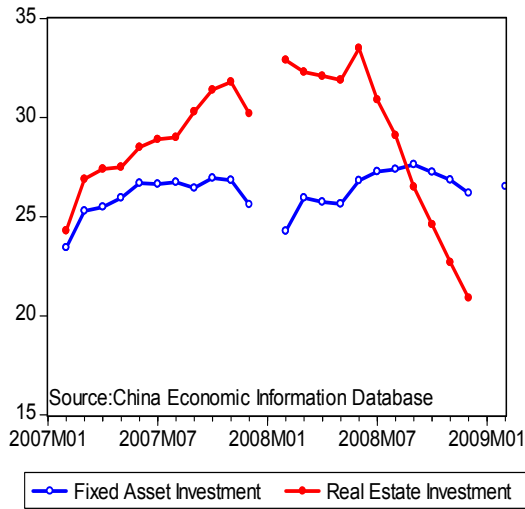
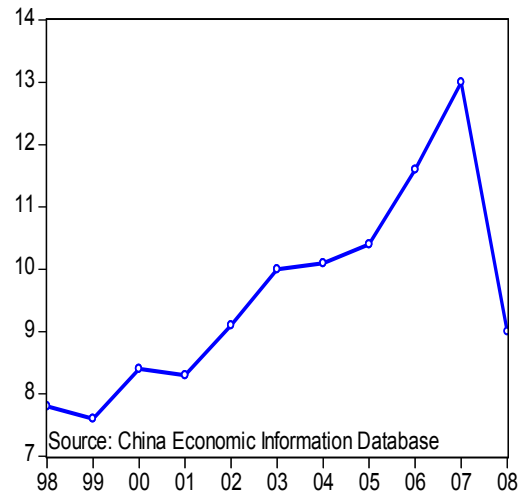


Figure 2-4 China's Annual GDP growth



Sudden loss of two traditional growth engine left year over year growth rate of GDP in the fourth quarter of 2008 at 6%, and annual GDP growth rate of 2008 at 9%, which stood at 13% in 2007. Some economists argue that if annualized seasonal adjusted quarter over quarter rate (annualized sa qoq) is applied to GDP growth rate of fourth quarter of 2008, corresponding annual growth rate goes to 1 or even negative. According to our study on China's GDP (Zhang Bin, 2009), we found it's not reliable to make estimation on China's qoq GDP growth based on existing public GDP data. If unadjusted public GDP data are employed to estimate quarter over quarter GDP growth rate, contradictions among those data exist. If we choose consistent data, the annualized quarter over quarter GDP growth rate could be quite different by applying different methods, varying from 1% to 5.6%.

Instead of using GDP growth rate, variables, such as electricity and cement, could be useful proxies to understand the dramatic changes of overall economic activity. We use seasonal adjusted variables minus their time trend to reveal the impacts of cyclical and external factors on the real economy. We found both electricity and cement production, which are warranted as good indicators to reveal overall economic activity, witnessed dramatic adjustment in the fourth quarter of 2008. Negative impacts of cyclical and external shock on electricity production recorded historical high in the 10 years sample period. Cement production adjustment was not as strong as electricity production, reflecting industrial sector suffered more from the negative cyclical and external shock than construction sector. Fortunately, in the first quarter of 2009, downward pressure was lessened in spite of electricity production still below zero line. The recovery of electricity and cement production were contributed by correction of over adjustment of depressing inventories in the fourth quarter of 2008 as well as the fiscal stimulus package.

Figure 2-5 Seasonal Adjusted Electricity Production minus Its Time Trend(100 billion watt.hours)

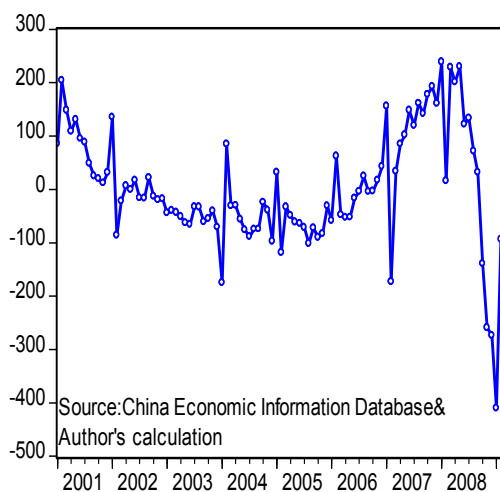


Figure 2-6 Seasonal Adjusted Cement Production minus Its Time Trend(10 thousands tons)



Approximately 20 million rural migrant workers lost jobs in the period of international financial turmoil. According to Mr. Chen Xiwen's speech in the news press of state council in 2th February, among 130 millions rural migrant workers, 15.3% of them lost jobs in the period of financial turmoil. Mr. Chen's statistics is based on a sampling investigation in 150 villages of 15 provinces, which was organized by Ministry of agriculture.

### Nominal variables

Balance sheets of financial institutions are healthy, less affected by financial turmoil in the short run. Thanks to cautious deregulation in China's capital account, private financial sector has very limited involvement in overseas financial market. Even though there is no complete statistics on total amount of loss in the period of financial turmoil, information from different channels indicate total loss in China's three major listed domestic commercial banks could be less than 3 billion US dollars. In 2008, capital adequacy rate in major commercial banks stand at 10%, and non-performing loan ratio 2%. Up to now, there are no financial institutions announced bankruptcies for its loss in overseas financial market.

M2 and Credit growth has been declining since the early of 2008 due to macroeconomic tightening policies and rebounded spectacularly in the first quarter of 2009. Same to real variables, bottom of M2 and credit growth was in November which can be explained partly by external shocks. However, thanks to monetary authority's switch from tight to moderate easing monetary policy stance, and government's huge fiscal expansion plans, banks expanded credit spectacularly by increased loans of 1.6 trillion and 1.07 trillion in January and February of 2009, which correspond to 18% and 20% yoy growth rate and are 3-4 percent higher than average level in past twenty years. In the context of looming or at least uncertain economic outlook, banks are still cautious on making loans to small and middle size enterprises, especially enterprises

in tradable sector. Loin's share of loan went to state owned large enterprises, which will benefit from government supported projects. In accordance with monetary authority's moderate easing policy stance, liquidity condition is good in financial institutions, inter-bank overnight lending rate kept low, varying from 0.9 to 1.5%.

Figure 2-7 M2 growth



Figure 2-8 Credit growth



Capital outflows were totaled around \$120-140 billion in the fourth quarter of 2008(Wright, 2009). Despite a record-high quarterly trade surplus of \$114.3 billion and additional sources of capital inflow, China's foreign exchange reserves rose by only \$40.4 billion in the fourth quarter. Adding valuation effects, RRR cuts effects<sup>3</sup> together, Wright estimated capital outflows was totaled around \$120-140 billion in the fourth quarter of 2008. Two major factors that contributed to capital outflows include expectation of limited RMB appreciation and deleveraging of foreign investors.

### Middle-long term impacts

The impact of international financial turmoil on Chinese economy could be long-lasting. Financial turmoil that started in US released a strong and clear signal that consumption and trade deficit growth in US could not catch up with export growth of East Asia, especially that of China. The increasing trade imbalance and finance linkage across Pacific Ocean in the past decade have been proven unsustainable. In the foreseeable future, contribution of export growth to China's overall economic growth will fade away. The changing external environments are a big challenge not only for export, but also for China's growth model. Unlike many other sectors, export in China is dominated in private sector and contributed lion's share of efficiency improvement. Chinese economic growth is highly dependent on the growth nexus among export, related investment, related labor income, related tax revenue and money creation. Behind this nexus, it is the government's incapability of incentive designing to expand domestic service sector as well as foster domestic demand.

<sup>3</sup> Commercial banks are used to making required reserve deposit in form of US dollars in central bank. When required reserve ratio is lowered in October and December of 2008, commercial bank's required reserve deposit in form of US dollars decreased, with equivalent increase in foreign reserves.

International financial turmoil forced government seek new growth engines from domestic markets. Fiscal stimulus package and reforms in many areas, such as medical care, education, pricing on energy and other natural resources, are underway. Those policies are treated as measure not only to make compensation for export growth slowdown, but also to improve growth sustainability. The old cycle is broken, but new one is not fully prepared. We will come back to this issue below.

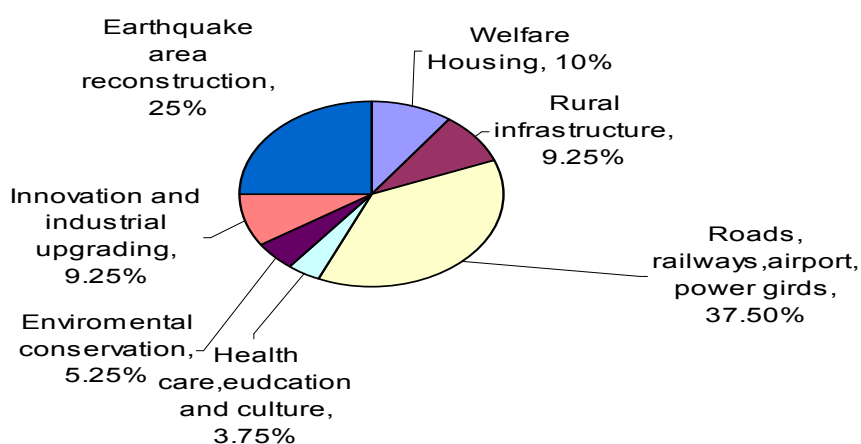
### III Chinese government's policy responses and their effectiveness

Confronted with unexpected worsening of international financial markets and severe downward pressure of domestic economy, ambitious stimulus policies were adopted by Chinese authority, which include four trillion fiscal stimulus packages from the end of 2008 to 2010, shifting moderate tightening to moderate easing monetary policy, industrial policies, reforms in medical and health care, reforms in pricing on energy and rural land, and so on.

#### **Fiscal stimulus package**

Four trillion fiscal stimulus plan attracted most eyeballs. In November of 2008, an ambitious four trillion fiscal stimulus package was announced by central government, which was out of market expectation and attracted many concerns. According to government, this stimulus package is aimed at economic growth, boosting domestic demand and improvement of economic structure. As is listed in Chart 3-1, infrastructure building accounts for the lion's share of total package. The existing pack structure is different with what it was firstly announced in November of 2008. The major difference is share of expenditure on health care, innovation and industrial upgrading, welfare housing increased by 2.75%, 5.25% and 3% respectively, share of roads, railways, airport, power grid decreased by 7.5%, environment conservation decreased by 3.5%, share of rural infrastructure and earthquake area reconstruction kept constant. Those adjustments were reflection of doubts on the effectiveness of too much infrastructure and more concerns on industrial upgrading and social welfare shortages.

Chart 3-1 4 trillion fiscal stimulus package structure



Sources: National Development and Reform Commission, author's calculation

There are various channels for financing of four trillion stimulus package. Among four billion trillion stimulus package, the central government is responsible for one quarter of the total amount, leaving the rest amount for local government by financing through local fiscal income (including tax and other income, such as land sales), bank loans, issuance of local government debts, or private sectors. Central government has been running good fiscal conditions with around 100 billion Yuan in 2008 and outstanding treasury bills to GDP ratio 22%. It is announced by government that total fiscal deficit will come to 950 billion (including 200 billion Yuan for local government debts) and deficit to GDP ratio stand at 3% in 2009, which is still within the safe line. Financing for local government is not that easy. One the one hand, local tax income growth are slowing down due to slowdown of overall economy; on the other hand, land sales income, which has been the major source for local infrastructure construction, dropped dramatically since 2008 due to contraction in real estate sector. To finance for fiscal stimulus plans, local governments are looking for help from commercial banks and central government. Large commercial banks exhibited great interests in making loans to central government supported big projects, which were selected by National Development and Reform Commission (NDRC) and partly support by central government finance. Some local government projects, which are not in the NDRC list and having no central government financing support, have to seek money from local commercial banks.

The major worries on fiscal stimulus package lie in its expenditure structure. Those worries include: (1) Efficiency of such a big amount of infrastructure investment is not promised. NPL in banking sector and corruptions will increase rapidly in the future. (2) It leave less room for necessary adjustment of real sector, such as washing out outdated production capacity in industrial sector and transferring resources from over-developed (in term of quantity rather than quality) industrial sector to

under-developed service sector; (3) Government's too much involvement in industrial sector, such as subsidies in innovation and industrial upgrading, will impair market competition and squeeze out private investment. Instead of making so much investment by government, many economists argue that government should (1) make more tax cut rather than spend money by itself; (2) give direct subsidies to people who are losing jobs and poor; (3) increase share of expenditure on public health and social safety network. Those worries attracted concerns from policy makers and the 4 trillion packages were adjusted to some extent to meet up with those worries.

In spite of those worries, fiscal stimulus may generate great help in term of increasing employment opportunities and securing economic growth at least in short run. Dong, Zhiwei and Wenlan (2009) estimate the effects of the fiscal stimulus package in Mainland China on its output and employment. Using the input-output table as the analytical framework, they argue that the announced fiscal spending of RMB2 trillion yuan in 2009 could lead to a direct increase of output of RMB1.7 trillion yuan, implying a fiscal multiplier of around 0.84 in the short-run, and could potentially generate 18 million to 20 million new jobs in non-farming sectors. Since the I-O analysis is static and does not consider the endogenous relative price changes, the long run effects of fiscal stimulus package could be quite different.

Fiscal stimulus plan encourages import growth, concentrating on machinery and equipment, and mining and quarrying. According to Dong, Zhiwei and Wenlan (2009), total intermediate imports amount to RMB317 billion Yuan (approximately 46 billion US dollars), around 16% of the fiscal package. Machinery and equipment sector sees an increase of intermediate imports of RMB98 billion Yuan, about 1.2 times the value added induced in that sector. The mining and quarrying sector sees the second largest increase in intermediate imports of RMB75 billion Yuan (approximately 11 billion US dollars), as the coking, gas and petroleum sector uses plenty of imported mining and quarrying products as inputs.

Table 3-1 Intermediate import induced by fiscal stimulus

Sector	Induced VA (RMB bn)	Induced Intermediate Imports (RMB bn)	Ratio of Induced Intermediate Imports to VA (%)
Agriculture	68.1	8.7	12.8
Mining & quarrying	120.6	74.8	62.0
Foodstuff	10.0	1.8	18.2
Textile, sewing, leather & furs products	9.0	4.4	49.5
Other manufacturing	36.4	12.0	32.9
Production & supply of Electric power, heat power and water	163.9	0.2	0.1
Coking, gas and petroleum refining	38.5	19.6	50.9
Chemical industry	42.1	38.8	92.1
Building materials and non-metal mineral products	47.4	2.0	4.3
Metal products	64.0	29.2	45.7
Machinery and equipment	81.6	97.7	119.8
Construction	182.7	0.1	0.0
Transportation, postal & telecom services	439.3	7.6	1.7
Wholesale & retail trades, hotels & catering services	86.2	5.9	6.8
Real estate, leasing & business services	119.7	7.1	5.9
Banking & insurance	47.6	4.1	8.5
Other services	126.1	2.8	2.3
Sum or Aggregate	1,683.2	316.8	18.8

Note: the result may vary with different scenarios on the fiscal expenditure structure  
Sources: Dong He, Zhiwei Zhang, and Wenlan Zhang, "How large will be the effect of China's Fiscal Stimulus Package on Output and employment", Hong Kong Monetary Authority Working paper 05/2009, March 2009.

## Monetary policy

As international financial crisis unfold, monetary authority took comprehensive measures to ensure liquidity supply in domestic financial markets and lower credit cost. The moderate easing monetary policy stance, which was firstly introduced in Q3 of 2008, includes quantity measures, interest rate cuts, stable RMB/USD rate, and so on.

Quantity measures include required reserve ratio cut, open market operations and release of quota management on loan growth for commercial banks. In the fourth quarter of 2008, People's banks of China (PBC) lowered required reserve ratio four times. Accumulated reserve ratio cut amounted to 2% for large scale commercial banks, and 4% for middle-small scale commercial banks. By the end of 2008, total liquidity released by 800 billion (PBC, 2009). PBC lowered its issuance of central bank

bills significantly in the fourth quarter in 2008 by 371 billion Yuan, which amounted 8% of total insurance of central bank bills in 2008. Quota management, which used to be the most effective instrument to restrain loan growth, was abolished.

PBC announced five interest rate cuts in the fourth quarter in 2008. One year base deposit interest rate decreased from 4.14% to 2.25%, one year base lending rate decreased from 7.47% to 5.31%. In the mean time, PBC decreased its lending rate to financial institutions by two times. Interest rate for required reserve deposit and excessive reserve deposit in central bank decreased from 1.89 to 0.99 and 1.62 to 0.72 respectively.

Thanks to PBC's active actions in quantity and interest rate policies, there is no evidence of liquidity shortage at least in the inter-bank markets. Inter-bank market overnight lending rate decreased dramatically and inter-bank transaction volume kept stable. Liquidity injection from central bank didn't automatically transfer into faster broad money growth instantly (as is shown in figure 2-7). Commercial banks, which have been facing with deteriorating value of collateral and worsening of real economy, were cautious on making new loans and leave more money in the form of excessive reserves in central bank. According to PBC (2009), commercial banks' average excessive reserve ratio amounted to 5.11% by the end of 2008, increased by 1.81% than that of 2007, resulting in declining of money multiplier and slower broad money growth.

Figure 3-1 Inter bank overnight lending rate

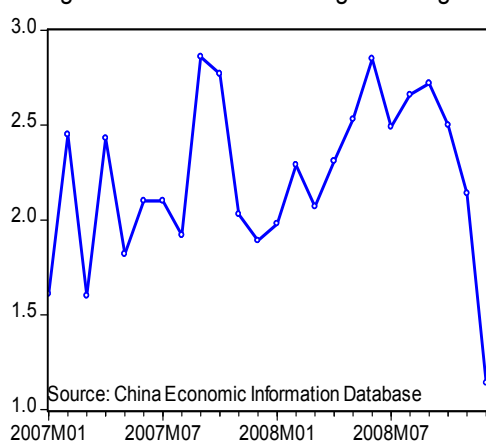
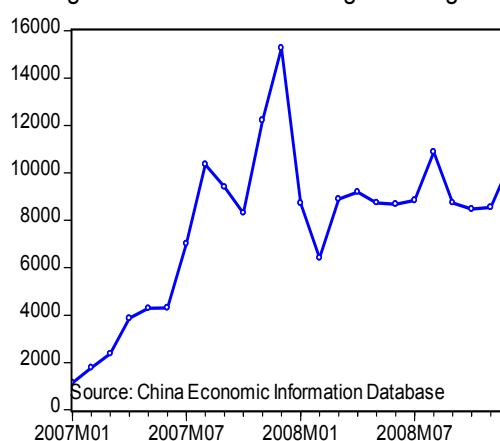


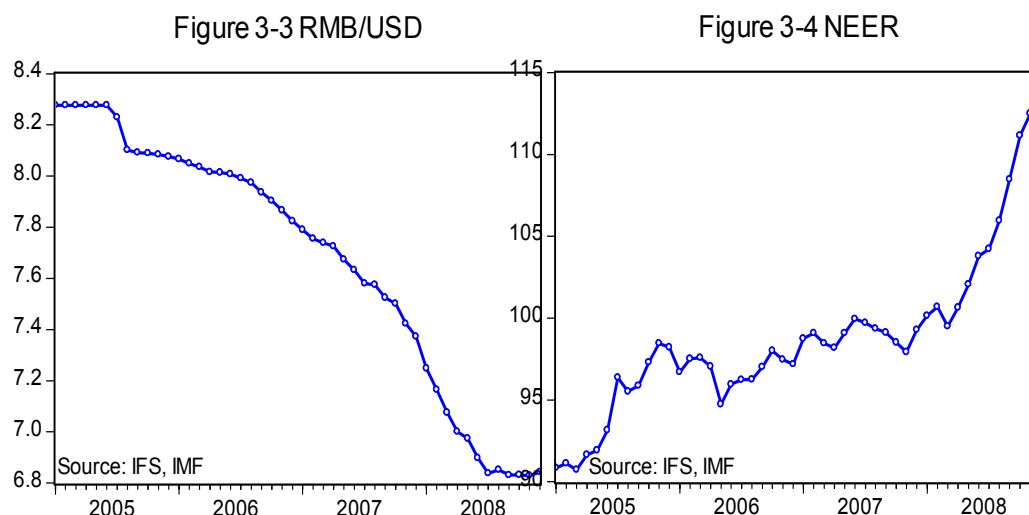
Figure 3-2 Inter bank overnight lending volume



Bank loan growth rebounded spectacularly in the first quarter of 2009. In January and February, year over year bank loan growth rate amounted to 21.3% and 24.5% respectively. This sudden change was contributed by (1) fiscal stimulus packages, in which many projects were partly financed by government; (2) abundant liquidity; (3) release of quota management on loan growth for commercial banks. Among those new loans, major contributing parts are long term loans for government backed infrastructure projects and short term commercial paper. As for private middle-small

size companies, commercial banks kept cautious in making loan.

In the second half of 2008, PBC has been keeping stable RMB/USD rate, while allowing Nominal effective exchange rate (NEER) appreciation. RMB's appreciation against USD, which was started in the July of 2005 and accelerated in the first half of 2008, was suspended in June of 2008 and RMB/USD rate kept stable since then. In the mean time, due to USD's appreciation against other currencies, NEER of RMB appreciated around 7-10 percent.



Objectives of RMB exchange rate policy are not changed. In the context of international financial turmoil and appreciation of USD, stable RMB/USD rate seems attractive to PBC for multiple of reasons: (1) stabilizing international capital flows, Further appreciation or depreciation of RMB against USD are thought as factor that will attract speculative capital flows and damage domestic macroeconomic stability; (2) alleviating domestic political pressures from export sectors. RMB/USD rate rather than NEER are widely thought as government's attitude toward export sectors; (3) achieving RMB's movement toward it's reasonable and equilibrium level, which was proposed as objectives of RMB exchange rate policy reform announced in July 21 2005. Up to now, in spite of rapid slowdown of China's export growth, RMB exchange rate is not used as policy instrument to promote export growth.

The moderate easing monetary policy stance facilitate financing for fiscal stimulus package and recovery of the economy in the short run at the expense of giving rise to another possible Non-Performing Loan (NPL) jump in commercial banks. The positive impacts of moderate easing monetary stance has been demonstrated by spectacular loan growth and weak recovery in industrial sectors in the first quarter of 2009. However, such a loan growth boom is thought to be unsustainable and dangerous. On the one hand, commercial banks are left with adequate liquidity; on the other hand, commercial banks direct most of those liquidity into loans to government supported infrastructure projects. As a result, the structure of commercial bank are reshaped by

increasing share of low yield reserve deposit in PBC , other forms of government debts, loans to infrastructure or other forms of government revenue backed projects, and decreasing share of loans to private sectors. From a long term view, this could be unsustainable since government revenue growth, which is the only promise of paying back interests and principal to commercial bank, is not promised without growing finance toward private sectors. Once the private investment and consumption growth nexus are not well developed, those loans to government or warranted by government revenue are not safe at all.

### **Other policies**

Industrial policies are regarded as instruments to ensure industrial upgrading and growth quality. Government announced ambitious industrial reinvigoration plans (see appendix 1 for details), which include ten major industries: auto, steel, textile, machinery, ship building, electronics and information, petrol-chemical, non-ferrous, logistics and light industry. Those industry invigoration policies are aiming at washing out out-of-date production capacities, boosting domestic demands, and pushing forward upgrading of industrial sectors. Those industry invigoration measures are featured by acquisitions and merges, tax cut, innovation investment.

Government seeks to deepen reforms in many fields, which are warranted as instruments to strengthening economic growth sustainability and enhancing social welfare. Reforms that draw major attentions from government and academics include: (1) medical and health care sectors, in which government are supposed to having more responsibilities in providing fundamental services and making deregulations; (2) pricing of rural land, energy and natural resources, exchange rate which are thought to be ineffective and underlying factors of structural distortion. Government should be replaced by market to do pricing jobs; (3) reforms in international finance architecture, especially international reserve currency reform (Xiaochuan Zhou, 2009).

Industry invigoration plans and reforms are reflections of government's endeavor in seeking for new growth engines. Since many of policies are under discussion and not implemented yet, we are not going to make evaluations on those policies. Instead, in the next part, we draw lessons from international financial crisis and propose policies that should be regarded as first priorities to rebalance Chinese economy and contribute to sustainability of global economic growth.

## **IV Lessons from Financial Turmoil and China's Rebalancing Strategy**

As international financial Turmoil unfolds, trade imbalance across Asia Pacific Ocean is lessened. Thanks to huge losses of nominal financial wealth, United States of

American is forced to reduce its consumption as well as import, and therefore increase its saving rate. As a result of sudden loss of external demand, China and its East Asia neighbors are forced to reduce production in its tradable sectors as well as export, and therefore decrease its saving rate by scarifying GDP growth. Even though China and its East Asia neighbors were not in the center of financial turmoil and suffered limited losses in their financial sectors, their loss in real terms are comparable to those economies who suffered more in financial markets.

Cyclical and structural factors amplified the magnitude of financial turmoil's negative effects on Chinese economy. From 2003 to 2007, China's GDP growth rate was averaged at 10%, 10.1%, 10.4%, 11.6% and 13% respectively, which are above the well accepted potential GDP growth rate 9-9.5%. In the mean time, GDP growth was more dependent on investment in tradable sector and real estate sector. Huge production capacity that was built in tradable sector left increasing gap between production and domestic demand, resulting in increasing dependency of export to overall economic growth. It can be concluded that once external demand collapsed, which are treated as indicators for both cyclical adjustment and structural adjustment, domestic economy will suffered more. High saving rate used to be the most important factor that explains both cyclical and structural problems. On one hand, high saving rate explain why there are so much trade surplus; on the other hand, high saving rate, by introducing continuous trade surplus, are linked with currency appreciation expectation, speculative capital inflows, loose monetary condition, asset bubble and overheated economy.

High trade surplus of China and many other East Asia economies are thought to be the result of high saving rate in those economies, but limited interpretations existed in this argument. As for the formula  $\text{Saving-Investment}=\text{Net Export}$ , many economists are used to interpret it from left hand to right hand and treat saving as a result of maximization result of household. In this argument, trade surplus are thought as maximization result of household and not related with exchange rate. Even for those who didn't treat saving and trade surplus as maximization result of household, policy implications of reducing trade surplus from this argument are limited to expanding domestic consumption and investment through improving social net work and financing from domestic savings to investment. We still can't find the role of exchange rate in redressing trade surplus. Obviously, the disconnection of exchange rate policy and trade surplus is not consistent with reality. The interpretation of this argument should be reconsidered.

The  $\text{Saving-Investment}=\text{Net Export}$  formula is an accounting identity, rather than behavior equation. As for China, high saving rate should not be treated as a result of maximization result of household. An interpretation from right hand to left hand of this equation is more consistent with reality and of much richer policy implications. As discussed in details below, we argue policies distortions that boost trade surplus will lead to many other side effects, such as worsening of income distribution, higher

saving rate, unparallel growth between GDP growth and welfare improvement, and so on. Currency appreciation expectation and its severe damage to macroeconomic stability should also be in this list, but we ignore this since it has been discussed for long time and concluded insightful views. We divide the following contents into three parts: firstly, we concluded two stylized factors of Chinese economy; secondly, we discuss the consequences of policy distortions in a tradable-nontradable model; thirdly, we propose China's rebalancing strategy. This strategy is relevant not only for China, but also for other East Asia economies who has been running long lasting trade imbalance.

## Two facts of Chinese economy

We introduce two facts of Chinese economy and policies behind these two facts. As is shown in table 4-1, the first fact is that tradable sector experienced faster TFP growth than that of nontradable sector. As is shown in Cao and others (2008), TFP growth in tradable sectors exhibited much higher than that of nontradable sector in general. This is particular true for the TFP growth differentials between export sectors and domestic monopoly sectors.

Table 4-1 TFP growth comparison between selected tradable and nontradable sectors

Tradable sector	non-elec. machinery	electrical machinery	instruments	primary metal	Fabricated metal	Motor vehicles
TFP growth	2.53%	4.04%	3.8%	6.46%	2.88%	2.9%
Nontradable sector	Oil and gas extraction	transportation	financial service	public service	other private service	Construction
TFP growth	-9.96%	-4.65%	-11.18%	-0.54%	-2.36%	-0.25

Source: Cao, J., M. Ho, D. Jorgenson, R. Ren, L. Sun, X. Yue (2008) "Industrial and Aggregate Measures of Productivity Growth in China, 1982-2000," Review of Income and Wealth

Among those factors that contribute TFP growth differentials between tradable and nontradable sectors, the role of different policies toward two sectors are vital. In the past two decades, tradable sectors witnessed systematic marketization reform. It was seen in detail that the marketization reform in tradable sector covers several key respects:

- (1) Market suppliers: A lot of non-state owned enterprises came out and became the major force to promote the growth in tradable sectors. A large-scale rebuilding on withdrawal, reorganization and share-holding has been made for the state owned enterprises. By the end of 2004, 1,464 companies among 2,903 large state-owned and state-holding enterprises in the whole country have been reestablished as corporate enterprises with multiple share-holding. The proportion of reestablishment is over 50%.
- (2) Market building: A thorough price system reformation has been made in most

tradable sectors and the market entry limits were loosened. Reasonable market competition order has been formed in most industrial sectors.

- (3) External environment: Tariff and non-tariff walls reduced; policy incentives are given to attract the direct investment from foreign countries.

It is no doubt that the above market reformation measures that has been successfully carried out has established a promise for technical advance and improvement of resource allocation efficiency in tradable sectors and helped to realize fast growth of TFP in tradable sectors.

In contrast to rapid and complete marketization reforms in tradable sectors, limited marketization reforms were made in nontradable sectors. In service nontradable sectors, such as education, medical health, environment, finance, communication, railway, and so on, limited improvement has been made in term of technology upgrading and resource allocation efficiency. The principal suppliers in above sectors are state-owned enterprises and the private sectors are confronted with high restrictions for market entry. Price control and market entry control are very popular, market competition is insufficient, and the monopolization in some industries are severe.

The second fact is lack of mechanism to facilitate adjustment in relative price of tradable to nontradable. As is shown in Balassa-Samuelson effects, faster relative TFP growth in tradable sector than that of nontradable will result in higher relative price of nontradable to tradable and following resource reallocation. Under the assumption that the country is a price taker in international market, there are two ways to realize the increase of relative price of nontradables to tradable: (1) Currency appreciation: Given the international market price of tradable, currency appreciation lower domestic price of tradable such as export, potential export, import, import substitution, etc, and the price of nontradables raises relatively to the price of tradable. (2) Inflation: Since the nominal exchange rate is unchanged and the international market price of tradable is given, inflation will translate into the higher relative price of nontradable to tradable. Either of the above ways results in appreciation of (internal) real exchange rate in accordance with definition of real exchange rate.

With high policy priority was given to both low inflation and stable RMB/USD rate, adjustment of relative price of nontradable to tradable required by TFP changes is limited. From 1995 to July of 2005, RMB/USD rate was fixed and RMB's real effective exchange rate (REER) movement followed USD's exchange rate against other major currencies closely. Since July 2005, with Chinese monetary authority announced RMB exchange rate reform, RMB has been appreciated against USD steadily and REER witnessed a steadily increase since then. However, from rapid accumulation of trade surplus in the period of REER increase, it can be concluded that adjustment of REER are not sufficient in term of allocating resource from tradable to nontradable and therefore redressing China's enlarging trade surplus.

## A tradable-nontradable model

The following model follows the basic structure of Balassa-Samuelson model<sup>4</sup>. The difference lies in two aspects: (1) we don't allow relative price of nontradable to tradable adjustment in response to relative TFP changes of nontradable sector to tradable sector. Instead, we allow marginal return to capital flexible, which was kept exogenous in classical Balassa-Samuelson model under the assumption of international capital mobility. By making these changes, we can explore, without relying on relative price of tradable to nontradable changes, what are impacts of relative TFP changes to other endogenous variables, such as marginal return to capital and labor. (2) We add demand side, which are not considered in the classical Balassa-Samuelson model, and explore what are the impacts of relative TFP changes to trade surplus, domestic economic structure as well as saving rate. For the sake of simplicity, we leave detail of model in appendix 2 and introduce our major conclusions as follows.

Without correspondent adjustment in relative price of tradable to nontradable, faster TFP growth in tradable sector than that of nontradable sector result in:

- (1) Decrease of capital-labor ratio in both tradable and nontradable sector
- (2) Increase of marginal return on capital and decrease of marginal return to labor.

Given total capital and labor fixed as a whole, why capital-labor ratio in both sectors are lowered as a result of faster TFP growth in tradable sector relative to nontradable sector? The key lies in different capital-labor ratio in two sectors. As a result of faster TFP growth in tradable sector relative to nontradable sector, both capital and labor flow from nontradable to tradable sector at the middle of high capital-labor ratio in tradable sector and low capital-labor ratio in nontradable sector (otherwise, new equilibrium can't be achieved). This will result in lower capital-labor ratio in both sectors. For example, tradable sector has 100 capital and 10 labor, with capital-labor ratio at 10:1; nontradable sector has 50 capital and 25 labor, with capital-labor ratio at 2:1; If capital-labor ratio flowing out from nontradable sectors to tradable is in-between, say 20 capital and 5 labor, the final result will be capital-labor ratio of tradable sector at 8:1 and nontradable sector at 1.5:1. In correspond to lower capital-labor ratio in both sectors, marginal return on capital increased and marginal return on labor decreased. As for the whole economy, share of compensation for labor decreased and share of compensation for capital increased.

- (3) Lower domestic consumption on tradable and nontradable and higher trade surplus and saving rate comparing with flexible relative price of tradable to nontradable.

Consider two effects of higher relative price of tradable to nontradable due to higher TFP growth in tradable sector than that of nontradable sector, one is substitution effect, the other is income effect. As for substitution effect, higher relative price of tradable to nontradable encourage domestic tradable consumption and domestic

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<sup>4</sup> See the updated Balassa-Samuelson model in Obstfeld and Rogoff (1996).

nontradable production. As for income effect, it encourages both tradable and nontradable consumption. If relative price adjustment fails to work, substitution effect fails to work. As for the income effect, it's also doubtful. As we have seen from above, faster TFP growth in tradable sector than that of nontradable sector, with exogenous relative price of tradable to nontradable, result in decreasing ratio of marginal return on labor to marginal return to capital, and therefore worsening of income distribution. The income effects of TFP growth on encouraging domestic tradable and nontradable consumption are much lessened, if not negative. Putting lost substitution effect and income effect together, it can be concluded that restriction of relative price adjustment of tradable to tradable in response to faster TFP growth in tradable sector than that of nontradable sector result in higher trade surplus and saving rate at expense of depressing domestic consumption on both tradable and nontradable.

### **China's rebalancing strategy**

Confronted with international financial turmoil, Chinese government's ambitious stimulus plans in boosting up domestic demand are timely and effective in term of avoiding over adjustment of the real economy. Drawback of those stimulus plans lies in its less contribution to redressing China's structural distortions and providing engines for sustainable growth. Over use of fiscal resources can be dangerous for its lacking of effectiveness and sustainability. Comprehensive domestic reforms and further international cooperation, rather than increasing government spending, should be given first priority in the next period. We propose China's rebalancing strategy as follows.

~ Firstly, more deregulation should be introduced in several service sectors, such as railway, medical care, education, finance, telecommunication, energy, express delivery, and so on. Deregulation policies should focus on relaxing market entry restrictions for private investment and reduction of government's intervention in pricing. In the short run, in the context of financial turmoil, those deregulation measures will be the best confidence promise for domestic demand for opening up a massive market, which has been depressed for long time and confronted with large unsatisfied demands, for private sector investment and releasing of job opportunities. In the long run, those deregulation measures, by improving TFP growth in above sectors, will (1) increase ratio of marginal return on labor to marginal return to capital, and therefore improve income distribution and enhance domestic consumption; (2) direct more resources to nontradable sector, rather than tradable sector. We regard those deregulation policies as the first priority in lowering China's saving rate and trade balance, and therefore rebalance Chinese economy.

~ Secondly, more government resources should be used in providing public health care, basic education for the poor, welfare housing, and other poverty reduction areas.

Government should be careful in expanding further infrastructures, such as high way and power grid, for their uncertainty of effectiveness in the future and therefore leave more resources for the poor. An exit strategy of exceptional fiscal stimulus should be put in place. In addition to tax revenue and government debt financing, SOE profits, which are contributed by monopoly power by large extent, should be submitted for public benefits. Above measure are aiming at increasing welfare as well as purchasing power of the poor and could be important in boosting domestic demand and rebalancing the economy.

~ Thirdly, pricing reform and reduction of favorable policies toward tradable sectors should be continued. China has been already taking active measures in pricing reform in RMB exchange rate, interest rate, energy price, and service price in many other sectors. The essence of pricing reform is to reduce government's influence in price making and therefore leave more room for price making to the market. In addition, favorable policies toward tradable sectors, such as lower land price and high tax rebate toward FDI enterprises and enterprises with high contribution to local GDP growth, has been regarded as another important factor that contributed to increasing share of China's industrial sector in overall economy. Government has been taking gradual measures in reducing those favorable policies since 2005. In the context of financial turmoil, which imposed severe negative impacts on China's tradable sectors in the short run, many pricing reforms and reduction of favorable policies toward tradable enterprises were suspended. Those reforms should be picked up and regarded as indispensable part of China's rebalancing strategy.

Fourthly, further cooperation within East Asia region as well as reform in international financial architecture is needed. In this paper, we focus our attention on China's domestic issues, especially China's high saving rate and structural distortions, and give directions for China's domestic reforms. However, in a global perspective, we understand that China's contribution to global economy recovery and redressing global rebalance is limited. Loose monetary policies in US and over dependency on US dollar in East Asia (by increase holdings of US treasury bills and other US dollar assets in their foreign exchange reserve assets) are underlying factors that increase global imbalance and fragility of East Asia economies. In the process of financial company bailout, US are running exceptional budget deficit and loose monetary policy and attract new worries of return of high commodity price. Once expectations of high commodity price result in inflation expectation and force US monetary authority to increase interest, the recovery of world economy would be in the shape of "W", rather than a sustainable recovery. It is time not only to redress internal structural distortions, but also to alleviate over dependency on US dollar and US monetary policy. To achieve this end, China and its East Asia neighbors should improve regional cooperation in term of developing regional financial markets and enhancing policy coordination.

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## Appendix 1

Key Principles and Elements of Industrial 'Reinvigoration' Plans Announced by Chinese Authorities

### **Auto Industry**

- ◆ Subsidies to scrapping of old cars (10% of purchase price of new car).
- ◆ Encouraging M&A to optimize resources and improve competitiveness on the international market; In the next three years, the central government will earmark Rmb10bn (or US\$1.46bn) as a special fund to support auto companies to upgrade technologies and develop new engines that use alternative energies.
- ◆ Offering financial support to promote the use of energy-saving autos and those fueled by new energies, and support automakers to develop independent brands and build export bases for auto and parts.
- ◆ Improvement in access to credit for car purchase
- ◆ Lowering the purchase tax on cars under 1.6 liters from 10% to 5% from Jan. 20 to Dec. 31 in a bid to stimulate sales
- ◆ Allocating Rmb5bn (or 730 million US dollars) to provide one-off allowances to farmers to upgrade their three-wheeled vehicles and low-speed trucks to mini-trucks or purchase new mini-vans under 1.3 liters from March 1 to Dec. 31

### **Steel Industry**

- ◆ Controlling the production capacity strictly by eliminating out-dated products and suspending the approval of capacity-expanding projects
- ◆ Developing the M&A headed by industry leaders to cultivate international-competitive players
- ◆ Allocating special funds in central budget to promote technology improvement of the sector, readjustment of product mix and improvements in product quality
- ◆ Disciplining the import order of iron-ore and sales of steel products by establishing risk-sharing mechanism between production and sales
- ◆ Balancing domestic and international markets by expanding home demand by spurring domestic consumption while implementing flexible export tax policy to retain stable international market share

### **Textile Industry**

- ◆ Strengthening technology innovation and domestic branding; and setting-up special fund to support industrial upgrading and cultivate well-known brands
- ◆ Accelerating elimination of outdated capacity by refining entry threshold, and providing favorable policies to industry leaders to take over troubled enterprises
- ◆ Optimizing geographic layout by encouraging reallocation of lower-added production to central and western regions while coastal areas being focused on high-tech, higher-added-value and low resource-consuming products; making Qingjiang as production and processing base of textile products.
- ◆ Strengthening fiscal, tax and financial support by raising the export rebate rate from 14% to 15% and providing credit to those enterprises with good fundamentals but

temporary financial difficulties;

- ◆ Balancing domestic and international markets by actively expanding domestic consumption via production innovation and exploration of rural markets, and keeping international market share via diversifying export destinations

### **Machinery Industry**

- ◆ Promoting structural adjustment and transforming growth pattern by supporting the M&A of market leaders; speeding up the standardization of products to develop modern processing service industry
- ◆ Taking advantage of the VAT reform to promote the technology upgrading
- ◆ Setting up special funds for industrial rejuvenation and technology upgrading in central budget
- ◆ Establishing the risk-compensation system to encourage use of locally-produced equipment
- ◆ Increasing quota of export credit to support machinery export
- ◆ Exempt for import tariff and VAT for key parts and raw materials for localization and re-innovation
- ◆ Gradually improving import-substitution of major machinery products in key projects such as clean-energy, UHV transmission, mining, and railway construction; promoting the automation degree in key industries such as steel, auto and textile;

### **Ship Building Industry**

- ◆ Suspending construction of new docks and the expansion of slipways for three years to facilitate industrial restructuring
- ◆ Arranging special funds for R&D of facilities to build high-technology ships and maritime engineering equipment and promote technical innovation
- ◆ Stabilizing the production by exploring domestic and international markets while controlling the expansion of new capacity and promoting structural adjustment
- ◆ Increasing credit support for ship buyers and extending the existing financial support policies for oceangoing vessels until 2012

### **Electronics and information industry**

- ◆ Strengthening the efforts in self-innovation by developing national science and technology projects and improving public technological service platforms
- ◆ Promoting outsourcing and encouraging electronics and information enterprises to go overseas and build research and development centers, production bases and marketing networks
- ◆ Strengthening policy support, such as the adjustment of recognition standards for high-tech enterprises, tax rebates for electronics and information product exports, export credit and insurance, and pilot program of issuing corporate bonds by SMEs
- ◆ Boosting the investment in 6 key projects such as 3G (third-generation) mobile communication services, digital TVs and next-generation internet

### **Light Industry**

- ◆ Speeding up technological progress by promoting localization of key equipments and technologies; establishing exit mechanism to promote energy saving and environmental protection
- ◆ Strengthening food safety by strengthening monitoring the food processing industry

and raising entry threshold; refining recall & withdrawal system and enforcing more severe punishment on fake foods

- ◆ Accelerating building-up of domestic brands by encouraging across-region M&A and raising the centralization degree
- ◆ Strengthening industrial policy guidance to promote industrial relocation and cultivation of industrial clusters
- ◆ Removing the restrictions on processing trades of some labor-intensive, or high-tech and energy-saving products; Further raising the export rebates and financial support to SMEs; Implementing “home appliance to countryside” program to spur rural consumption
- ◆ Promoting both urban and rural consumption while improving trade service to maintain international market share

### **Petro-chemical Industry**

- ◆ Improving the supply capacity of farming materials by adjusting production structure, optimizing resource allocation, lowering production cost and perfecting fertilizer reserve system
- ◆ Controlling production capacity and eliminating outdated capacity by suspending approval of capacity-expanding projects in coal chemical industry such as coke and calcium carbide
- ◆ Well-planning the layout of key projects and promoting technology improvement
- ◆ Strengthening policy support building of finished oil product reserves, better tax policies and more credit access for firms
- ◆ Stabilizing the industrial operation by stimulating domestic consumption via reviving key industries and increasing agricultural production

### **Non-ferrous Industry**

- ◆ Controlling production capacity strictly and accelerating elimination of outdated capacity
- ◆ Strengthening technology progress, optimizing industrial layout and improving competitiveness by M&A
- ◆ Accelerating the recycling system of nonferrous system to improve the comprehensive usage of resources
- ◆ Providing low-interest-rate loans to support the technology improvement, accelerating the establishment of national reserve system, and adjusting the product structure of export tax rebates
- ◆ Stabilizing and expanding domestic market by adjusting product structure to meet the domestic demand while improving export environment by supporting the exports of high-tech and high-added value products

### **Logistics Industry**

- ◆ Speeding up the M&A to cultivate a group of internationally-competitive logistic enterprises which could provide high-standard service
- ◆ Promoting the logistic service in key industries such as energy, mining, auto, agricultural products and pharmaceuticals by accelerating the development of international and tax-free logistics
- ◆ Strengthening the logistic infrastructure by improving standardization and

informatization of the whole industry

◆ Increasing the market demand of logistic market by promoting the socialization and professionalization of logistic industry.

## Appendix 2: tradable-nontradable Model

Economy is composed of tradable and nontradable sectors, and two sectors meet following form of Cobb-Douglas Production Functions:

$$Y_T = A_T F(K_T, L_T) = A_T K_T^a L_T^{1-a}$$

$$Y_N = A_N G(K_N, L_N) = A_N K_N^b L_N^{1-b}$$

In which, subscript T stands for tradable sector, while subscript N stands for nontradable sector;  $Y, A, K, L$  stands for output, TFP, capital and labor respectively;  $0 < b < a < 1$ , representing higher capital intensity of tradable sector than that of nontradable sector.

The representative firms of two sectors have following maximum problems:

$$\text{Max} \sum_{s=t}^{\infty} \left(\frac{1}{1+r}\right)^{s-t} [A_{T,S} F(K_{T,S}, L_{T,S}) - w_S L_{T,S} - \square K_{T,S+1}]$$

$$\text{Max} \sum_{s=t}^{\infty} \left(\frac{1}{1+r}\right)^{s-t} [q_S A_{N,S} F(K_{N,S}, L_{N,S}) - w_S L_{N,S} - \square K_{N,S+1}]$$

In which  $\square K_{i,S+1} = K_{i,S+1} - K_{i,S}$ ,  $i = T, N$  (no depreciation); price of tradable is 1, and relative price of nontradable to tradable is  $q$ . Assume  $k_t = K_t / L_t$ ,  $k_n = K_n / L_n$ , marginal return on capital and labor are :

$$r = A_T a k_T^{a-1} \quad (1)$$

$$r = q A_N b k_N^{b-1} \quad (2)$$

$$w = A_T (1-a) k_T^a \quad (3)$$

$$w = q A_N (1-b) k_N^b \quad (4)$$

In the above system,  $r, w, k_t, k_n$  are endogenous variables, standing for marginal rate of return on capital, labor, capital-labor ratio of tradable sector and capital-labor ratio of nontradable sector respectively. The endogenous  $r$  assumes implicatively incomplete international capital mobility. To explore the consequence of distorted relative price of tradable to nontradable, we assume relative price  $q$  being

exogenous in above system; besides,  $A_t, A_n, a, b$  are also exogenous variables in this system.

(3)/(1) =  $w/r = \frac{(1-a)}{a} k_t$ ; (4)/(2) =  $w/r = \frac{(1-b)}{b} k_n$ , combine them together and get:

$$k_n = \left( \frac{1-a}{a} / \frac{1-b}{b} \right) k_t \quad (5)$$

Combine ( 1 ) , ( 2 ) , and put into ( 5 ) , we have:

$$k_t = k_t(q, A_t / A_n, a, b) \quad (6)$$

$$k_n = k_n(q, A_t / A_n, a, b) \quad (7)$$

$$r = r(q, A_t / A_n, a, b) \quad (8)$$

$$w = w(q, A_t / A_n, a, b) \quad (9)$$

We can derive from the above system:

$$\partial k_T / \partial \left( \frac{A_T}{A_N} \right) < 0; \partial k_N / \partial \left( \frac{A_T}{A_N} \right) < 0; \partial r / \partial \left( \frac{A_T}{A_N} \right) > 0; \partial w / \partial \left( \frac{A_T}{A_N} \right) < 0;$$

Conclusion 1: with exogenous relative price of tradable to nontradable and other conditions being equal, faster TFP growth in tradables sector than that of nontradable sector result in (a) decrease of capital-labor ratio in tradable sector; (b) decrease of capital labor ratio in nontradable sector; (c) increase of marginal return on capital r; (d) decrease of marginal return to labor w.

Why does faster improvement of TFP growth in tradable to nontradable result in above effects? (1) Provided relative TFP of tradable sector to nontradable sector are increased, this will result in higher marginal return on capital in tradable sector than that of nontradable sector. As a result, capital are shifted from nontradable to tradable

sector at higher level of marginal return on capital (  $\partial r / \partial \left( \frac{A_T}{A_N} \right) > 0$  ); (2) Bearing in mind that tradable sector with higher capital-labor ratio than that of nontradable sector, provided the flowing out capital-labor ratio from tradable to nontradable sector is in-between both ratios (otherwise, new equilibrium can't be achieved), the final results are lower capital-labor ratios in both tradable and nontradable

sectors(  $\partial k_T / \partial \left( \frac{A_T}{A_N} \right) < 0; \partial k_N / \partial \left( \frac{A_T}{A_N} \right) < 0$  ). For example, tradable sector has 100

capital and 10 labor, with capital-labor ratio at 10:1; nontradable sector has 50 capital and 25 labor, with capital-labor ratio at 2:1; If capital-labor ratio flowing out from

nontradable sectors to tradable is in-between, say 20 capital and 5 labor, the final result will be capital-labor ratio of tradable sector at 8:1 and nontradable sector at 1.5:1. In response to lower capital-labor ratio, it is consistent with decreasing of

$$\partial w / \partial \left( \frac{A_T}{A_N} \right) < 0;$$

marginal return on labor (  $\frac{A_T}{A_N}$  ).

Assume total amount of capital and labor of both sectors being constant, and are utilized sufficiently, we can easily get:

$$(K - K_T) / (L - L_T) = k_N \left( \frac{A_T}{A_N}, \dots \right), \quad k'_{N, \frac{A_T}{A_N}} < 0$$

$$K_T / L_T = k_T \left( \frac{A_T}{A_N}, \dots \right), \quad k'_{T, \frac{A_T}{A_N}} < 0$$

Then we have

$$L_T = L_T(k_T(\dots)) = \frac{K / k_T \left( \frac{A_T}{A_N}, \dots \right) - uL}{(1-u)} \quad (10)$$

$$L_n = L_n(k_n(\dots)) = \frac{L - K / k_t \left( \frac{A_T}{A_N}, \dots \right)}{1-u} \quad (11)$$

In which  $u = \frac{k_n}{k_t}$ , from formula (5) we know it is a constant  $\left( \frac{1-a}{a} / \frac{1-b}{b} \right)$ . From formula (10)/(11) we have,

$$\frac{L_t}{L_n} = \frac{K / k_T \left( \frac{A_T}{A_N}, \dots \right) - uL}{L - K / k_t \left( \frac{A_T}{A_N}, \dots \right)} \quad (12)$$

$$\partial L_t / \partial \frac{A_T}{A_N} > 0; \partial L_n / \partial \frac{A_T}{A_N} < 0 \quad \partial (L_t / L_n) / \partial \frac{A_T}{A_N} > 0$$

Conclulsion 2: with exogenous relative price of tradable to nontradable and other conditions being equal, faster of the TFP growth in tradable sector than that of nontradable sector result in transferring of labor from the nontradable sector to tradable sector, and higher employment proportion of tradable sector to nontradable sector.

Using (10), (11) and production function of both sectors, we have

$$\frac{Y_N}{Y_T} = \frac{A_N}{A_T} \frac{Lu^b k_T (\frac{A_T}{A_N}, \dots)^{1-a+b} - Ku^b k_T (\frac{A_T}{A_N}, \dots)^{b-a}}{K - Lk_T (\frac{A_T}{A_N}, \dots)} \quad (13)$$

The above equation can further be reconstructed as  $\frac{Y_N}{Y_T} = \frac{A_N}{A_T} F(k_T (\frac{A_T}{A_N}, \dots), \dots)$ , and

$$\frac{\delta F(\dots)}{\delta (\frac{A_T}{A_N})} < 0$$

with  $\frac{\delta(Y_N/Y_T)}{\delta(A_T/A_N)} < 0$ ; Further, we have

Conclusion 3: with exogenous relative price of tradable to nontradable and other conditions being equal, faster of the TFP growth in tradable sector than that of nontradable sector result in higher output of tradable sector to nontradable sector. In order to discuss the effect of the above structural changes on trade balance and saving rate, it is necessary to introduce demand side. Assume the representative household has following maximization problem:

$$\text{Max } U_t = \sum_{s=t}^{\infty} \beta^{s-t} u(E_s)$$

In which, expenditure level  $E$  includes the expenses of tradables  $E_T$  and nontradables  $E_N$ , which also meets constant substitution elasticity function in form of:

$$E(E_T, E_N) = [m^{\frac{1}{\theta}} E_T^{\frac{\theta-1}{\theta}} + (1-m)^{\frac{1}{\theta}} E_N^{\frac{\theta-1}{\theta}}]^{\frac{\theta}{\theta-1}}$$

s.t.  $E_T + qE_N = E$

In which,  $E$  stands for overall expenditure level;  $\theta$  stands for substitution elasticity of tradable and nontradable,  $\theta > 0$ ,  $m$  and  $(1-m)$  stand for expenditure share of tradable and nontradable respectively,  $0 < m < 1$ . Solving the above problem, we have

$$\frac{mE_N}{(1-m)E_T} = q^{-\theta} \quad (14)$$

Formula (14) shows that expenditure ratio of tradable sector to nontradable sector are depending on relative price of both sectors, substitution elasticity of tradable and nontradable, and expenditure shares  $m$ , not related with total expenditure level of

both sectors. The expenditure ratio of tradable to nontradable remains exogenous provided relative prices being exogenous. Formula (13) can also be written

$$\text{as } E_T = h(q, \theta, m)E_N .$$

The trade balance can be formulated as:

$$TB = Y_T - E_T$$

$TB$  Stands for the trade balance,  $Y_T$  stands for the production of tradables,  $E_T$  stands for expenditure of tradable, trade balance equals to domestic tradable production minus domestic tradable consumption. Divided by tradable output on the two sides of above equation, we have

$$TB/Y_t = 1 - E_t/Y_t$$

( 15 )

In which, the proportion of domestic tradable consumption and domestic tradable production can be formulated as:

$$E_t/Y_t = \frac{h(q, \theta, m)L_n(..)A_n g(k_n(..))}{L_t(..)A_t f(k_t(..))} \quad ( 16 )$$

In which,  $E_T = h(q, \theta, m)L_n(..)A_n g(k_n(..))$  .

$$\text{Easy to figure out, } \frac{\partial E_t/Y_t}{\partial(A_T/A_N)} < 0 \quad \text{or} \quad \frac{\partial(TB/Y_t)}{\partial(A_T/A_N)} > 0 .$$

Conclusion 4: with exogenous relative price of tradable to nontradable and other conditions being equal, faster of the TFP growth in tradable sector than that of nontradable sector result in decreasing share of domestic tradable consumption in overall tradable production, and increasing share of trade balance to tradable production. Increase of trade balance can be treated as forced savings due to lack change of relative price of nontradable to tradable.

This conclusion can be illustrated more directly through the following figure. On the original position, production possibility margin is inner curve in the figure; the straight line from the original point to the right upward position represents the expenditure proportion of tradable to nontradable, the curve remains stable when relative prices of tradable to nontradable being exogenous; the tradable production = tradable expenditure = OT; nontradable production = nontradable expenditure = ONT; trade balance is 0. Due to faster improvement of TFP of tradable relative to nontradable, the production possibility margin shifts to outer curve, results in asymmetrical expansion in tradable production. Keeping constant relative prices of tradable to nontradable, the tradable production in new production possibility margin is OT' and nontradables' ONT'; as for the demand side, however, domestic tradable consumption does not expand in line with expansion of tradable production, on the contrary, due to that the

expenditure ratio of tradable and nontradable remains fixed, the decrease (caused by the decrease of nontradable production) of expenditure of nontradable is in line with decrease of domestic consumption of tradable. Finally, tradable production is much larger than its domestic consumption, resulting in trade balance of  $ET'T$ .

Figure A1 Tradable and Nontradable Sectors

