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“Firm Productivity and the Current Account: One Country with Two Financial Markets“

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Abstract

This paper relates China's current account surplus, as well as productivity differential between state-owned (SOEs) and privately-owned enterprises (POEs), to differences in access to finance. I consider an open-economy DSGE model of the Chinese economy with two productive sectors. I model SOEs and POEs as start-ups which need to borrow in order to begin production. Following a policy-induced asymmetric shock to the borrowing constraints, SOEs are on average less productive than POEs. Because of the lower hurdle rate for investment they face, SOEs end up creating more investable assets than POEs, while, due to more constrained credit availability, POEs save more and invest less than SOEs. In aggregate, this simple mechanism implies investment (driven by less productive SOEs) does not keep up with savings (driven by more productive POEs), resulting in a current account surplus. Furthermore, the savings of Chinese POEs owners in search of investable foreign assets put downward pressure on the world long run real interest rate. Earlier literature either discusses China's current account and productivity differentials separately, or assumes one phenomenon to explain the other. My paper shows that they could jointly be explained in general equilibrium by preferential access to credit for government backed firms.

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1 Introduction

Three facts have dominated the discussion on the Chinese economy and global macroeconomics:

Fact 1: The state-owned enterprises (SOEs) on average have lower productivity level compare to privately-owned enterprises (POEs) in China (see Figure 1).

Fact 2: The Chinese economy has run a persistent current account surplus since the early 1990s; the counterparts of its surplus has been the deficit in the United States, the United Kingdom and other advanced economies[1](see Figure 2).

Fact 3: The long run real interest rate has been declining over the last decade (see Figure 3), despite recent efforts from central banks to raise interest rates - The "Greenspan's Conundrum".

Despite extensive studies on various factors driving this environment, there are very few formal structures to analyze these joint phenomena. The growth literature deals with fact 1 (Brandt, Hsieh and Zhu (2008) and Brandt and Zhu (2010)), while international macroeconomics deals with facts 2 and 3, although these facts are deeply integrated in practice. In this paper I argue that such separation between the real economy and the financial market is not warranted when productivity differential in China is an important driving force behind the last two set of facts. Hence it must be made an integral part of analysis if we are to conjecture on what got the world into the current situation and how it is likely to get out of it.

There have been many papers documented the productivity differential between SOEs and POEs in China. Song, Storesletten and Zillibotti (2011), using the ratio between net fixed asset investment and total profit as a measure of productivity, show the productivity gap between SOEs and POEs is about 9 percentage point per year, and a similar figure was reported by Islam, Dai and Sakamoto (2006). I confirm these results by comparing output to total asset ratio between SOEs and POEs across 28 manufacturing industries (see Figure 27). From the TFP accounting point of view, Brand, Hsieh and Zhu (2008) estimate an average TFP gap between POEs and SOEs of 1.8 during $1998 - 2004$, while Brandt and Zhu (2010) estimate a gap of 2.3 in 2004. Furthermore, using a different methodology, Hsieh and Klenow (2009) estimate a "revenue-TFP" of 1.42.

A number of theories argue that the global imbalances is the product of credit

[1]India, a country which is at a similar stage of financial development as China (according to the Ease of doing Business Index see Figure 21), has completely opposite 'experiences' in current account balance. The Indian story suggests that, it is difficult to explain China's current account surplus by just focusing on the aggregate financial underdevelopment.

frictions in Emerging Markets (EMs) have emerged in recent years. These papers focus on fact 2 or 3, while fact 1 is largely ignored. Caballero, Farhi and Gourinchas (2006) primarily analyze the collapse of asset market in newly industrialized economies (or EMs). Following a collapse in the asset market, newly industrialized economies' abilities to supply financial assets to savers are reduced, so savings flow towards advanced economies in search of investable assets, and long run interest rate declines. The key mechanism in their paper, is a collapse in the asset market leads to a reduction in agents' borrowing abilities, which transfer to a reduction in domestic asset supply one to one. Moreover, both investments and outputs in newly industrialized economy remain unaffected by the shock (ignoring fact 1). However, financial friction has proven to be one of the most important factors behind both investment and economic development (see Jeong and Twonsend (2006), Amaral and Quitin (2010), Buera, Kaboski and Shin (2009), Moll (2010), Greenwood, Sanchez and Wang (2010) and Midrigan and Xu (2010)). In contrast, I explicitly model the impact of borrowing ability on investment and output, via firm's entry decision, which permits the interplay of both saving and investment in determining capital flow. In this paper, shock to a firm's borrowing ability affects firm's optimal entry decision. These decisions form the industry composition, in turn affect the equilibrium productivity level, furthermore the new industrial composition will interact with the financial shock in shaping domestic saving and investment rates. Coeurdacier, Guibaud and Jin (2011) explain the high saving rates in EMs, as a consequence of households in EMs have tighter liquidity constraints (relative to households in Advanced Economies). However, liquidity constraint should be a dynamic concept; by keeping it fixed the key picture will be missed. Moreover, on the saving side, Mendoza, Quadrini and Rios-Rull (2009) show that lower risk sharing opportunities in developing countries increase precautionary savings so that when opening up to capital markets, these countries see a net capital outflows. However, risk is likely to be of second-order compared to the rapid productivity growth in EMs. Some other papers have put the emphasis on corporate savings. Sandri (2010) shows that in the face of uninsurable investment risks, firms rely on precautionary savings to finance future investment opportunities. Benhima and Bacchetta (2011) show that credit-constrained firms in EMs demand liquidity to finance investment in periods of high productivity growth with the assumption that demand for foreign bonds is a complement to domestic investment when firms are credit constrained. In both papers, corporate savings rise above investment, and the outcome is a net capital outflow, although it is unclear that corporate savings are the force behind the current account imbalances. Bayoumi, Tong and Wei (2010), using firm level data, show that corporate saving rate has fallen in China; furthermore, Chinese firms do not have a significantly higher savings rate than the global average. It is the household savings rates in China, however is much higher compares to advanced economies.

On the investment side, Buera and Shin (2010), emphasize a suppression of investment demand due to financial frictions. While investment slowed down

during the East Asian crisis, it quickly reverted back to a beyond the pre-crisis level in Emerging Asia, making investment a less plausible candidate for explaining the recent divergence in global imbalances. Furthermore, Song, Storesletten and Zillibotti (2011) provide a framework to explain some facts during China's economic transition. The key assumption in their paper is that, POEs are more productive relative to SOEs ex-ante, and the mechanism behind is that resources re-allocate to more productive POEs over the transition, as a result the size of financially integrated SOEs shrink, and domestic savings are stored in foreign assets. Essentially, their paper analyses fact 2, but largely ignores fact 3 and takes fact 1 as exogenous anomalies. However, Brandt, Van Biesebroeck and Zhang (2009) show the average entry and exit rate of Chinese firms is around 6 percent each year, and the Chinese high TFP growth over the period 1998 - 2006 is primarily driven by the new entrants where the contribution of reallocation of resources towards firms with higher productivity is very small. Furthermore, Figure 4 and 5 compare the fixed investment and output levels between SOEs and POEs, these figures indicate no sign of SOEs are slowing down, although they confirm the fact that POEs are catching up, but these do not imply SOEs are shrinking. In this paper, I do not assume POEs are more productive than SOEs ex-ante, although the average productivity of SOEs is lower compared to POEs. However, it is the equilibrium outcome where SOEs and POEs compete to start up productions, given they have different borrowing abilities, and it is this competition to start up interacts with asymmetric credit conditions force only the "super" productive POEs to enter. Why should I focus on the *start-ups*? Since size of the initial fixed cost to set up production is much larger relative to the re-financing cost, borrowing constraint must play a greater role at a firm's start-up stage; secondly, once a firm has its own production plant, it becomes much easier to obtain a bank loan, because the fixed assets such as land, is the most important collateral used by the commercial banks (especially in EMs like China) when they assess the credit worthiness of the POEs. Given firms' large entry and exit rates, in this paper I investigate the impact of borrowing abilities on firms' entry decisions. To analyze such a situation, I model firms' entry decisions as commonly found in the international trade literature see Hopenhayn (1992) and Melitz (2003), with additional borrowing constraints incorporated.

Above all, it is widely acknowledged that the financial markets in EMs have developed in the past decades, especially in China as confirmed in Figure 6[2]. Therefore, if any of the current account imbalances are driven by the different borrowing constraints, we should expect the current account surplus in China to shrink and the savings in EMs to decrease. In this paper, I argue the level of aggregate financial development is just a sideshow when asymmetric financial markets co-exit within the economy.

Dooley, Folkerts-Laudau and Garber (2003) and Dooley and Garber (2005)

[2]Figure 6 illustrates the total loan outstanding between 1990 to 2008.

argue that the current pattern of US external imbalances does not represent a threat to the global macroeconomic environment. Their "Brent Woods II" analysis states that the structure of capital flows is optimal from the point of view of developing countries trying to maintain a competitive exchange rate, to develop a productive tradable good sector. Unlike theirs, my analysis emphasizes the role of private sector capital flows, and argues that the exchange rate is just a sideshow given the recent irresponsibility of current account balances to the real appreciation of RMB.

Matsuyama (2007) studies the composition of credit and shows that credit traps and credit collapse can happen when different borrowing constraints co-exit[3] within an economy. The main focus is on how an agent's net worth can cause the composition of the credit and hence the investment decision, however the implication on saving decisions hence fact 2 and 3 remain silent.

The main purpose of this paper is to provide a framework to analyze global equilibrium when two financial markets[4] co-exit in one country, and as an important side product to shed some light on facts 1, 2 and 3. The model is designed to highlight the role of asymmetric borrowing constraints, in particular the interaction between different borrowing abilities and firms' entry decisions in shaping the aggregate productivity level, saving and investment decisions, moreover international trade, global capital flow and world equilibrium interest rate. The model is fairly standard in its ingredients, and is based on three building blocks - goods, labour and asset markets, each interacting with the others via equilibrium conditions. I use this model to show that the facts above, can arise naturally when the Chinese financial market hits by a shock such that after the shock, for one set of the firms (SOEs) it becomes easier to borrow, while at the same time for the remaining firms (POEs) it becomes more difficult to borrow.

The striking divergence in credit allocation between SOEs and POEs appears in Figure 7, 9 and 10, where both private and public funding markets reveal the same striking trend. In the early 1990s, before the current account take off in China, rather small differences in borrowing abilities were observed. Although financial markets have developed across EMs during the past two decades, the progress has been 'slightly' different in China, in particular SOEs see their borrowing abilities improved much more relative to POEs', while the aggregate financing condition improved on average. These observations rise two important questions, firstly is it plausible to consider an economy with asymmetric borrowing constraints by a representative economy with one 'averaged' financial market? Secondly, how much does the existence of asymmetric financial markets 'contribute' to not only the Chinese economy but the world equilibrium? The

[3]The fraction of future income that can be pledged in current period is argued as the borrowing constraint.

[4]A set of firms have same financial market implies these firms have the same borrowing ability.

answer to the first question is "No" and in this paper I show many facts in the Chinese economy can be explained by the co-existence of asymmetric borrowing constrains, furthermore its impact on shaping the world equilibrium.

Consider a world consists of only two regions - home (China or similar countries with asymmetric financial markets) and foreign (US and other economies such as UK), I investigate the implications of a shock in the home region which worsens the borrowing constraints for one set of firms, at the same time loosens the borrowing constraints for the remaining firms[5]. More importantly, I want to emphasis the equilibrium outcomes in an economy which has two financial markets, are very different from an economy has just one financial market which is measured by the average of the two financial markets. Firms with better access to credit (SOEs) will prevent the POEs with average productivity enter the market through competition, as a result only the "super" productive POEs can enter, who produce cheaper output and drive the large export in the home region (as observed in China). The benchmark framework consists of multiple open economies, characterized by an overlapping generation structure. This structure provides scope for both international and intergenerational borrowing. In both regions, all agents are subject to a borrowing constraint, but the key is that within the home region, asymmetric borrowing constraints co-exist. The borrowing constraint matters, since prior entering to production, each firm needs[6] to borrow against its present discounted value of future profits in order to finance an initial fixed asset investment[7], the fraction of present discounted value of future profit a firm can pledge is argued as its borrowing constraint[8], and the weighted average across all firms' borrowing abilities is argued as a region's financial market development. Each firm's profit level is proportional to its productivity and market share, so for a given level of borrowing ability, firms' entry decisions pin down a reservation productivity level where only firms with higher productivities can enter production. When a 'negative' shock hits home agents' borrowing abilities[9], home region's aggregate demand for investable assets (or saving) increases because: 1, SOEs take advantage of better access to the credit market, force the average productive POEs out of the competition, so only the "super" productive POEs can enter to production, therefore in equilibrium the average productivity of POEs is higher relative to SOEs; 2, the price level of final goods produced using POEs' intermediate inputs falls (due to cheaper POEs' input prices), which leads to an improvement in home region's

[5]To be consistent with empirical evidences, throughout this paper I label firms that have better access to the credit market as SOEs, and firms that have relatively worse borrowing abilities as POEs.

[6]I assume the initial fixed cost is too large relative to each agent's/firm's saving, so the potential entrant has to borrow.

[7]This fixed cost can be seen as the initial set-up cost i.e. firm's expenditure on purchasing factory plant or machineries.

[8]Throughout the paper, I use words: credit constraint, borrowing constraint and borrowing ability interchangeably, but they all refer to the same concept as defined here.

[9]In particular, this shock increases the borrowing abilities for SOEs and simultaneously reduces the borrowing abilities for POEs

trade balance and higher POEs' profit levels; 3, since POEs can borrow less, POEs owners' saving increases as they cannot channel their profits to potential POEs' investment projects; 4, on the other hand, SOEs take advantage of better credit market access, boost investment at the same time generate new investable assets; 5, however, SOEs' investment opportunities are limited by their lower (relative to POEs) productivity levels; 6, therefore the rate of new asset generated by SOEs is not able to match up with the rate of saving increases in home region; 7, as a result a large capital outflows towards foreign region; 8, excess saving from the home region in searching for investable foreign assets, puts downward pressure on the world equilibrium interest rate.

Finally to close the world asset market equilibrium, the supply of investable assets increase from the foreign region is driven by a higher demand for the foreign produced final goods from the households in home region (since POEs owners receive higher profits, their consumption increases, in turn leads to a higher demand for both home and foreign produced final goods).

The paper is organized as follows. Section II will lay out some stylized facts about the Chinese economy, which rationalize the main assumptions in this paper, section III presents some VAR evidence to empirically establish the connection between the current account balances and asymmetric borrowing abilities, section IV is the core of this paper where I present the main model and mechanisms. Section V supports the main quantitative claims with different experiments. Section VI concludes with policy implications.

2 Some Stylized Facts in the Chinese Economy

2.1 A Brief History of the Chinese Financial System and Macroeconomic Trends

China introduced its first economic reform in December 1978. The early reforms reduced land collectivization, increased the role of local government and communities, and experimented with market reforms in a few selected areas. During which the People's Bank of China (PBOC) departed from the Ministry of Finance and became a separate entity, at the same time three state-owned banks took over some its commercial banking business. The Bank of China (BOC) was given the mandate to specialize in transactions related to foreign trade and investment; the People's Construction Bank of China (CCB), originally formed in 1954, was set up to handle transactions related to fixed investment (especially in manufacturing); the Agriculture Bank of China (ABC) was set up in 1979 to deal with all banking business in rural areas and the PBOC was formally established as China's central bank; finally, the forth state-owned commercial bank, the Industrial Commercial bank of China (ICBC) was formed in 1984,

and it took over the rest of commercial transactions of the PBOC[10]. As a result of such reforms in policy and banking sector, the role of private sector underwent a substantial change. As rural China was in the ascendancy, where peasants were free to set up manufacturing, distribution and services businesses that were allowed to retain profits, pay dividends, issue share capital and even a form of stock option, state-owned banks rushed to provide the finance (see Huang (2008)). However, this fundamental shift in policy was not sustained, since the 1990s, China had adopted the "Shanghai model" of rapid urban development that favored massive SOEs and big foreign multinational companies, as a result of which the countryside suffered and indigenous entrepreneurs were starved of funds and strangled with red tape. As Huang (2008) points out, the worst weaknesses of China's state led capitalism - a reliance on creaking state companies rather than more efficient private ones and the weak financial sector are increasing distorting the economy. This is not the only work that shows the non uniform financial repression; Boyreau-Debray and Wei (2005) document that the Chinese banks that are mostly state owned, tend to offer easier credit to SOEs, so the financial system severely weakens the efficient allocation of capital, and the private capital does not seem to be large enough to undo the inefficiency associated with the government dictated finance. As a result, SOEs finance more than 30 percent of their investment through bank loans, compared to less than 10 percent for POEs in 2003 (see Song Storesletten and Zillibotti 2011). Similarly, Dollar and Wei (2007) and Riedel, Jin and Gao (2007) report that POEs rely significantly less on bank loans for investment. Batra, Kaufmann and Stone (2003) provide survey evidence on over $10,000$ firms in eighty-one countries around 2000. The subjective perceptions of Chinese entrepreneurs concerning the financial constraints they face are quite similar to those prevailing in other transitional economies, such as Croatia, the Czech Republic, Romania, and Slovak Republic, or in poor economies, such as Ghana and Ethiopia. Furthermore, other forms of market financing are marginal for privates firms. Despite the rapid growth of the Chinese stock market in recent years, equity and debt markets continue to play an insignificant role for POEs, while these markets have become increasing important for large semi-privatized SOEs[11] (Gregory and Tenev (2001) and Riedel Jin and Gao (2007) chapter 7).

Some surveys organized by the Chinese government reach similar conclusions. A research report based on a private-sector survey conducted in 2002

[10]Note, the four state-controlled commercial banks posses more than 80 percent of the whole banking sector's assets and liabilities, and they account for around 80 percent of the lending and 70 percent of the deposit business. Furthermore, given they originally were assigned different tasks, they do not compete in all business and geographic areas with each other.

[11]In this paper, I use SOEs and POEs as approximations for the set of firms who have better and worse borrowing abilities. I notice that some of the semi-privatized SOEs, also fall into the POEs category in my dataset, despite they have 'good' access to credit market, due to data limitation it is very difficult to disentangle these firms from the other POEs, therefore the empirical evidences provide at least a measure of the lower bound of asymmetric borrowing abilities.

concludes[12]:

"In the survey, many private firms say that financing is difficult. The problem always exists. Government, banks, firms, All-China Federation of Industry and Commerce have made many efforts but no improvements were observed. We can see from the survey that lending to the private firms is scarce and that informal sources represent a substantial part of a firm's finance."

Huang (2008) using firm level data, shows the share of POEs, ranked formal finance as an important source for starting up has declined from 24.5 percent between 1984 - 1989, to 19.6 percent in 2001.

There are many ways to confirm these results, in this paper I look at some direct measurements, namely how much of loan, syndicated loan and bond have issued to SOEs and POEs (bear in mind that POEs on average are more profitable compare to SOEs). The total loans outstanding in the Chinese economy stood at 11.23tr RMB by 2001, and this number had grown nearly 4 times as large by the end of 2009, to 40tr RMB. Beside the rapid development in financial market, another striking trend also arose - the differences between SOEs and POEs in accessing to loan finance[13] show in Figure 7. Moreover, syndicated loan issuance data in Figure 9 confirms the same message[14].

The bond market in China has been dominated by government issuance, which had an annual growth rate of 27 percent between 1990 and 2005, in terms of new bond issuance. The second largest component of the bond market is called "policy financial bonds", which are issued by the policy banks and operated under the supervision of the Ministry of Finance, with the proceeds of bond issuance being invested in government-run projects and industries. Despite the fact that corporate bonds are minuscule compared to the size of government bonds, in terms of the amount of outstanding bonds at the end of 2005, corporate bonds are only one-eleventh, SOEs also dominated the corporate bond market. A number of possible reasons for the underdevelopment of bond markets in China could be, the lack of sound accounting systems and high quality bond rating agencies as well as a well-constructed yield curve. Figure 10 shows this striking divergence between corporate bond issuances between SOEs and POEs.

The credit allocation in China, is far more 'complicated' than just the trend documented above, after the official credit plan was abolished in 1998, events drove the allocation of the credit on an ad-hoc basis were frequently implemented ...

[12] http://www.china.com.cn/chinese/zhuanti/283076.htm

[13] The loan issuance date is obtained from China Monthly Statistics, and the numbers are consistent with Allen, Qian and Qian (2008)

[14] The possible reasons behind the trend are out of scope for this paper, although some papers have proposed a few possible explanations see Huang (2008) and Shil (2004).

2.2 Some Unexpected Events

Policies designed to control both *quality* and *quantity* of new credit issuance, unintentionally distort the credit allocation in the Chinese economy, in particular these policy interventions unexpectedly lead to a larger gap in borrowing abilities between SOEs and POEs. In this subsection I discuss some monetary policy events, though which I argue as unexpected 'side-effects', these policy interventions lead to a distortion in credit allocations within the Chinese economy.

Monetary Policy - 2003 was a major turning point as the Chinese government steered away from an expansionary path to prudent monetary policy. I list a few important interventions carried out by either the People's Bank of China (PBC) or the China Banking Regulatory Commission (CBRC) to control both the quality and the quantity of the new credit issuance, which describe below.

Credit - Quality

Window Guidance - The PBC started to adopt the policy of "Window Guidance" in 1998 and it has seemed to be one of the most important tools to guide the domestic loan increases due to insufficient interest rate elasticity of loans in China. This policy uses benevolent compulsion to persuade banks and other financial institutions to stick to official guidelines. Despite the phrase "guidance", which implies a voluntary aspect in the system, the PBC has a major influence on lending decisions, especially those of the four state-controlled commercial banks. In essence, during each of the Window Guidance meetings, policy makers require banks to improve the quality of new loan issuance, in order to control credit risk. Since it is much more difficult to accurately assess the credit worthiness of POEs relative to SOEs[15], due to an underdeveloped credit assessment system in China, as a 'side-effect', this policy intervention tends to widen the gap between SOEs' and POEs' borrowing abilities.

On June 5, 2003, the PBC initiated a particular Window Guidance process to curb the expansionary tendency in the economic cycle 2003/2004. In second half of the same year, the PBC asked for Window Guidance meetings three times in the second half of 2003; in those meetings on July 18, August 11 and September 12, the PBC invited representatives of all Chinese financial institutions and repeatedly asked them to pay attention to the capital adequacy ratio to prevent credit and liquidity risks. Beginning in 2004, monthly assessments of the PBC "to review economic and financial development and strengthen warnings for the commercial banks to guard against potential risks" were added to the Window Guidance policy. Additionally, a large-scale Window Guidance meeting with all commercial banks took place on March 23 2004, with the target of setting up a credit restriction mechanism according to the commercial banks'

[15] One possible reason why lending to SOEs are less risky despite the large non-performing loans, it is majority of the SOEs are backed by local or central government.

risk-control abilities and their capital adequacy. The monthly assessments were continuous throughout year 2005. Since April 2006, a significant strengthening of Window Guidance has been recognized. Six meetings were scheduled on 27 April, 18 May, 13 June, 15 August, 3 November and 8 December. All meetings came shortly after respective meetings by the State Council called for prudent macroeconomic policies to prevent credit risk and rein in excessive loan growth. In the meetings, financial institutions' representatives were "urged to comprehensively, correctly and actively complement the macroeconomic management policies formulated by the central government". The number of Window Guidance meeting decreased to 2 in 2007.

Figure 8 shows the de-trended[16] difference in bank lending between SOEs and POEs, and the month which Window Guidance meeting ("event") was carried out. Data suggests that following the event of Window Guidance, an unexpected increase between the loans held by SOEs and POEs is observed, which confirm lack of a robust credit worthiness assessment system in China, as a result of such, any policy designed to control the quality of new credit issuance unintentionally widen the borrowing abilities between SOEs and POEs.

Remark: I notice the Window Guidance is not the only event which causes the difference between POEs' and SOEs' borrowing abilities, as it is always difficult to identify these events, but Figure 8 does suggest Window Guidance is one of these events which unexpectedly widen the borrowing abilities between SOEs and POEs[17].

Credit - Quantity

Despite the fact that credit plan was officially abolished in 1998, preferential lending to certain areas and industries is still observed. During the recent economic crisis, the Chinese government implemented a 4 trillion RMB stimulus package to prevent a slowdown in the Chinese economy from the global financial crisis. The package was injected into economy via central government direct credit and instructed bank lending, however many evidences suggest majority of the funding was channeled to SOEs. Thus, credit allocation does not follow cost-utility criteria, in the sense that credit allocation is not steered by the price but by the required or desired amount of money. In essence, there is still a quasi credit plan in effect, although, most importantly, compared to the long-term determination of the official credit plans of former times, the amount of driven credit allocation of today serves on an *ad-hoc* basis. Notice, since the four state-controlled commercial banks are in favor of lending to SOEs; therefore, any form of credit tightening at aggregate level will pass through to POEs relatively more than SOEs. As a result, any policies designed to control the

[16] I use hp-filter calibrated to monthly frequency to remove the trend in the data.

[17] Year 2005 stood out from the trend, one reason behind the huge fall was due to a dry up in new loan issuance at national level, as the planned target loan growth was expected at 14.1 percent and the actual growth was at 9.8 percent.

quantity of new credit issuance, will also unintentionally lead to a larger gap in borrowing abilities between SOEs and POEs.

Reserve Requirement - Table 1 shows the development of the reserve requirement in China since 1985. This table illustrates how the regulators passively used the instrument between 1985 and 1998 and the ever increasing activity since 2003. These moves partly reflect how PBC's regard reserve requirement ratio as a main instrument to control liquidity in the financial system, and also show how the PBC have restrained the monetary and credit aggregates of the economy since 2003, and more severely in the recent years.

Open Market Operations[18] *(OMO)* - On May 26th, 1998 the Chinese authorities officially re-introduced open market operations. Before 27 February 2003, open market operations were generally carried out every Tuesday. Since 11 May 2004, the operation has generally been conducted on a two day a week basis. Open market operations include national bonds, central bank bills and financial bonds from other financial institutions, the so called policy bank. From May 1998 to mid-2000 only repurchasing operations were utilized for the sole purpose of issuing base money. Since mid-2000, however, a major shift has taken place: repurchase agreements were increasingly used to withdraw base money from the financial system. In 2003, the PBC started to additionally issue central bank bills[19].

3 Evidence from a Simple VAR

Figure $22 - 23$, present impulse responses (with 68 and 90 percent confidence bands respectively) from a simple VAR with the Chinese current account balance (CA) and the differences between loan issued to SOEs and POEs (Ldiff), between 1994 and 2009. I use this VAR[20] to document the key relationships in the data, and to provide a qualitative assessment of the simulated model.

Here all the variables are expressed in logarithmic terms. The shocks are othogonalized in the order of the differences between log of loans issued to SOEs and POEs and the log of Chinese current account balance. Due to data limitation, the analysis can only be carried out at annual frequency; however, the results already suggest a positive response to the current account balance after a shock to the borrowing ability, and it converges back to 0 after 2 time periods.

Furthermore, I carry out a similar exercise but with improved sample size. Figure $24 - 26$ present impulse responses from a VAR with the log of US vs

[18] see table 2 for a list of the OMOs

[19] see table 3 for a list of the central bank bills, designed to withdraw the liquidity.

[20] Identification assumption: I assume that the policy makers do not foresee the current period current account balance when they carry out policy interventions.

China bi-lateral current account balance (CA), the log of Chinese GDP (GDP), and the differences between loans issued by SOEs and POEs (Ldiff), at quarterly frequency. The results confirm a positive response of both the current account balance and China's GDP after a shock to the borrowing ability.

In this paper, I construct and estimate a model that is consistent with these facts and that can be used for policy analysis. I start with a basic model, which conveys the intuition.

4 The Basic Set Up - A Closed Economy

Time is continuous, infinitesimal agents are born at a rate ρ per unit time and exist at the same rate, population mass remaining constant. A cohort born at time zero has a size, as of time t, of $\rho e^{-\rho t}$, and the size of the population at any time t is $\int_{-\infty}^{t} \rho e^{-\rho(t-s)} ds = 1$.

Following Blanchard (1985), I assume that private markets provide insurance, and agents will contract to have all of their wealth return to the life insurance company contingent on their death, such that agents do not need to worry about longevity risk of death; more specifically, if an agent's wealth is w, they will receive ρw if they do not die, and pay w if they die.

Consumption

• Individual Consumption.

Denote $c(s,t)$, $a(s,t)$ and $w(s,t)$ consumption, per period income and wealth of an agent born at time s, as of time t. Let r_t be the interest rate at time t, τ be the agent's time discount. Under the assumption that instantaneous utility is logarithmic, agent maximizes:

$$\int_t^{\infty} logc(s,v) e^{(\tau+\rho)(t-v)} dv \tag{1}$$

subject to the dynamic budget constraint:

$$\frac{dw(s,t)}{dt} = (r_t + \rho) w(s,t) + a(s,t) - c(s,t) \tag{2}$$

which can be integrated to give:

$$\int_t^{\infty} c(s,v) e^{-\int_t^v (r(\mu)+\rho) d\mu} dv = w(s,t) + h(s,t) \tag{3}$$

So the optimal consumption path is:

$$c(s,t) = (\rho + \tau)(w(s,t) + h(s,t)) \tag{4}$$

Individual consumption depends on total individual wealth, with propensity $(\rho + \tau)$.

where:

$$h(s,t) = \int_t^\infty a(s,v) e^{-\int_t^v (r(\mu)+\rho) d\mu} dv \tag{5}$$

• Aggregate Consumption.

Let C_t, W_t and H_t denote aggregate consumption, wealth and income at time t.

Aggregating equation (4) across all agents in the economy at time t leads to:

$$C_t = \int_{-\infty}^t c(s,t) \rho e^{\rho(s-t)} ds = (\rho + \tau)(W_t + H_t) \tag{6}$$

Now, I assume that household income is equally distributed: $a(s,v) = a_v$ for all s, i.e. a household's income is independent of when he was born, furthermore define $A_v = \int_{-\infty}^v a(s,v) \rho e^{(s-v)\rho} ds$.

The aggregate income can be expressed as:

$$\begin{aligned} H_t &= \int_{-\infty}^t h(s,t) \rho e^{\rho(s-t)} ds \\ &= \int_t^\infty A_v e^{-\int_t^\mu (r_\mu + \rho) d\mu} dv \end{aligned} \tag{7}$$

Differentiate with respect to time:

$$\frac{dH_t}{dt} = (r_t + \rho) H_t - A_t \tag{8}$$

The aggregate wealth:

$$W_t = \int_{-\infty}^t w(s,t) \rho e^{\rho(s-t)} ds \tag{9}$$

Differentiating with respect to time gives:

$$\begin{aligned} \frac{dW_t}{dt} &= w(t,t) - \rho W_t + \int_{-\infty}^t \frac{dw(s,t)}{dt} \rho e^{\rho(s-t)} ds \\ &= w(t,t) - \rho W_t + (r_t + \rho) W_t + A_t - C_t \end{aligned} \tag{10}$$

to arrive at the second line, I used equation (4).

Furthermore, I assume that agents have no initial wealth $w(t,t) = 0$, then aggregate wealth is characterized by:

$$\frac{dW_t}{dt} = r_t W_t + A_t - C_t \tag{11}$$

Collecting equations:

$$\begin{aligned} C_t &= (r_t + \tau)(W_t + H_t) \\ \dot{H}_t &= (r_t + \rho)H_t - A_t \\ \dot{W}_t &= r_t W_t + A_t - C_t \end{aligned} \tag{12}$$

These equations reduce to:

$$\begin{aligned} \dot{C}_t &= (r_t - \tau)C_t - \rho(\rho + \tau)W_t \\ \dot{W}_t &= r_t W_t + A_t - C_t \end{aligned} \tag{13}$$

Production

Two types of good exist, final good B is used for consumption and intermediate goods are used for final good production.

• Final Good Production.

Final good B is produced by aggregate of ω_B differentiated intermediate inputs, which I normalized to 1.

$$Y_{B,t} = \omega_{B,t}\left(\int_0^1 y_{B,t}(i)^{\frac{\theta-1}{\theta}} di\right)^{\frac{\theta}{\theta-1}} \tag{14}$$

Final good B producer faces perfect competition, who minimizes its total cost by choosing the level of intermediate inputs, for a given level of output $\bar{Y}_{B,t}$, yields the following demand for intermediate input $y_{B,t}(i)$ at time t:

$$y^*_{B,t}(i) = \frac{1}{\omega_{B,t}}\left(\frac{p_{B,t}(i)}{P_{B,t}}\right)^{-\theta} \bar{Y}_{B,t} \tag{15}$$

Where, $P_{B,t}$ is the price index for final good B at time t and $p_{B,t}(i)$ is the price for intermediate inputs i.

The price for good B has the following expression (more on this later):

$$P_{B,t} = \left(\int_0^1 (p_{B,t}(i))^{1-\theta} di\right)^{\frac{1}{1-\theta}} \tag{16}$$

• Intermediate Good Production.

Each intermediate good producer faces monopolist competition, who takes the demand as given (from the final good producer), and sets a price with a constant markup over its marginal cost. Intermediate good production requires only one factor of input - labour, which is inelastically supplied at aggregate level. Firm's technology is represented by a cost function that exhibits constant marginal cost. Labour is thus a linear function of output q: $l = \frac{q}{\varphi}$. All firms have different productivity levels indexed by $\varphi \geq \varphi_{min}$. Higher productivity is modelled as producing a symmetric variety at lower marginal cost, or it can also be thought as producing a higher quality variety at equal cost. Regardless of its productivity, each firm faces a residual demand curve with constant elasticity θ and thus chooses the same profit maximizing markup. This yields a pricing rule for a firm producing variety i:

$$p_{B,t}(i) = \left(\frac{\theta}{\theta - 1}\right)\left(\frac{v_t}{\varphi(i)}\right) \tag{17}$$

Where the profit function for an intermediate firm i at time t can be written as:

$$\begin{aligned} \pi_{B,t}(i) &= \left(p_{B,t}(i) - \frac{v_t}{\varphi(i)}\right) y_{B,t}(i) \\ &= \left(\left(\frac{v_t^{1-\theta}}{\theta - 1}\left(\frac{\theta}{\theta - 1}\right)^{-\theta}\right)\frac{\varphi^{\theta-1}(i)}{\omega_{B,t}} P_{B,t}^{\theta} \bar{Y}_{B,t} \end{aligned} \tag{18}$$

v_t is the wage rate at time t, which is determined by the labour market clearing condition, to arrive the second line, I substitute in the demand curve for intermediate good i.

Intermediate Firm Entry and Exit Decisions

• Entry.

There is a large (unbounded) pool of prospective entrants into intermediate goods production. I assume that firms are owned by agents[21], initially each firm draws a specific initial productivity parameter φ from a common distribution $g(\varphi)$. $g(\varphi)$ has positive support over $[\varphi_{min}, \infty)$ with corresponding cumulative distribution $G(\varphi)$. To enter, each firm must makes an initial investment modelled as a fixed entry cost $F_B > 0$, which is thereafter sunk. To finance this initial fixed cost firm needs to borrow, the fraction of its present discounted value of future profits, the firm can pledge (denote by δ_t) reflects this firm's borrowing ability. Therefore each firm given its productivity draws, knowing the entry cost (F_B) and its borrowing ability, they simultaneously choose to

[21] This assumption serves one purpose: intermediate firms' profits will transfer to household.

enter the intermediate goods production or not.

Therefore, a potential entrance will enter intermediate good production if and only if he makes a non-negative profit by entering[22] and has sufficient borrowing to finance the initial fixed investment that is:

$$\delta\pi_\infty(i) - F_B \geq 0 \tag{19}$$

Where $\pi_\infty(i)$ is the present discounted value of future profits for intermediate firm i[23].

$$\pi_\infty(i) = \int_t^\infty \pi_s(i) e^{-\int_t^s (r(\tau)+\rho)d\tau} ds \tag{20}$$

Let Π_t denotes the aggregate (across all intermediate firms) profit in the economy at time t.

$$\Pi_t = \omega_{B,t} \int_0^1 \pi_t(i) di \tag{21}$$

The reservation productivity at time t is determined ($\varphi^*_{B,t}$) at which the firm is indifferent between enter or not, therefore, all the potential entrants with a productivity draw higher than $\varphi^*_{B,t}$, will decide to enter the production in intermediate good.

$$\delta_t \pi_\infty(\varphi^*_{B,t}) - F_B = 0 \tag{22}$$

Given the reservation productivity, the equilibrium number of intermediate good firms ($\omega_{B,t}$) at time t is pinned down by:

$$\omega_{B,t} = 1 - G(\varphi^*_B) \tag{23}$$

Remark 1: Under this setting, as $\delta_t \to \infty$ the reservation productivity approaches to the lower bound of productivity distribution ($\varphi^*_{B,t} \to \varphi_{min}$), where φ_{min} can be seem as the TFP level in the region.

Remark 2: The fixed entry cost (F_B) is constant despite firm's output and profit levels, seems at first sight implausible. However, letting the fixed entry cost vary with firm's profit level is equivalent to vary the borrowing ability and a constant fixed entry cost (F^f). For example: let $F^v(\Pi_\infty)$ denote the fixed cost, a firm has to pay prior to entry, which is a function of the profit level, for simplicity, I assume $F^v(\Pi_\infty) = F^f * (\Pi_\infty)^\beta$, where F^f is a constant and $0 < \beta < 1$, then firm's entry decision becomes $\delta_t \pi_\infty(i) - F^v(\Pi_\infty) = 0$ which is equivalent as $\delta_t^{\frac{1}{1-\beta}} \pi_\infty(i) - (F^f)^{\frac{1}{1-\beta}} = 0$.

[22] This condition requires $\pi_\infty(i) - F_B \geq 0$, since $\delta < 0$ this condition always hold as long as firm's borrowing condition is satisfied.

[23] Note, since the agent owns the firms, firms also exit at the point agent dies.

• Exit.

Once a firm successfully entered the intermediate good production, it has to pay per period running cost f_t (to its current owner/agent) financed by firm's current period profit[24]. This cost can be seem as the additional compensation to the managers. Therefore, intermediate firm can only continues to produce if and only if:

$$\pi_t(i) - f_t \geq 0 \tag{24}$$

Otherwise, firm exists the production at time t. I discuss f_t in more detail in the calibration section.

Asset Market

The corporate bond issued by intermediate firms (to finance the initial fixed cost) is the only saving option (investable assets) for the agents, which yield a return of $\delta_t \Pi_t$ per unit time.

Let V_t denotes the total corporate bond outstanding at time t. By arbitrage, the instantaneous return from holding a unit of bond r_t, satisfies:

$$r_t V_t = \delta_t \Pi_t + \dot{V}_t \tag{25}$$

The equation says, return on bond equals the divined price ratio $\delta_t \Pi_t / V_t$ plus the capital gain $\dot{V}_t / V_t$.

Recall the total savings accumulated by active agents at date t, denote by W_t is increasing with the income and the return accumulated on savings, decreases with consumption.

$$\dot{W}_t = r_t W_t + A_t - C_t \tag{26}$$

Asset market equilibrium imposes $V_t = W_t$, which pins down the domestic equilibrium interest rate.

Labour Market

For simplicity I assume that labour are inelastically supplied at aggregate level L, therefore the labour market clearing condition imposes:

$$\omega_{B,t} \int_0^1 l(i) di = L \tag{27}$$

where, $l(i)$ is the employment per intermediate firm (i) and L is the population size, moreover, the wage rate is pinned down by:

[24]Similar results are concluded if I assume instead firm finance this cost by using retained earnings.

$$\omega_{B,t}\int_0^1 l(i)di = \omega_{B,t}\int_0^1 \frac{y_{B,t}(i)}{\varphi_t(i)}di \tag{28}$$

gives the equilibrium wage rate:

$$v_t = \left(\frac{\theta-1}{\theta}\right)\omega_{B,t}^{-\frac{1}{\theta}}\left(\frac{\alpha}{\alpha+1-\theta}\right)^{\frac{1}{\theta}}\varphi^{\frac{\theta-1}{\theta}}P_{A,t}\bar{Y}_{B,t}^{\frac{1}{\theta}} \tag{29}$$

Given the wage rate, the aggregate household income at time t is the sum of the wage income, profit from intermediate firm minus the fixed investment.

$$A_t = v_t L + (1-\delta_t)\Pi_t - \rho w_t F_B \tag{30}$$

Note, the intermediate firm owners can only keep $(1-\delta_t)$ fraction of the profit each period and remaining δ_t fraction of the profits are paid back to the bond holders.

5 The World Economy

This section services two purposes: firstly, as the title suggested, to consider an open economy version of the model above, which provides the framework to study global equilibrium; Secondly, to introduce the asymmetric financial markets.

The world is sliced up to two large regions, home (h) and foreign (f) i.e. $j = (h, f)$, home can be seen as region consists of developing countries i.e. China, and foreign region consists of advanced economies i.e. U.S. or U.K. as discussed before.

Each of the regions is described by the same setup up as in the closed economy, let C_t^j denotes the consumption of country j at time t. Furthermore, final goods and corporate bonds are traded across the border, and intermediate goods and labour are only used within each region for production.

Recall the consumer's inter-temporal consumption decision

$$\dot{C}_t^j = (r_t - \tau)C_t^j - \rho(\rho+\tau)W_t^j \tag{31}$$

Each region j produces one type of final goods i.e. Bh, Bf, which are traded across the border, therefore, consumer in each region consumes both final goods, with intra-temporal consumption decision given by:

$$C_t^j = (1/2(c_{Bh,t}^j)^{\frac{\theta-1}{\theta}} + 1/2(c_{Bf,t}^j)^{\frac{\theta-1}{\theta}})^{\frac{\theta}{\theta-1}} \tag{32}$$

Given CES preference, the demand for good Bj by the residents in region $z = h, f$ satisfy:

$$c^z_{Bj,t} = \left(\frac{P_{Bj,t}}{P^z_t}\right)^{-\theta} C^z_t \tag{33}$$

The aggregate demand for final good Bj is the sum of the demand from both regions, hence equilibrium in final good markets require:

$$Y_{Bj,t} = c^h_{Bj,t} + c^f_{Bj,t} \quad j = h, f \tag{34}$$

with the following price index P^j_t:

$$P^j_t = (1/2P^{1-\theta}_{Bh,t} + 1/2P^{1-\theta}_{Bf,t})^{\frac{1}{1-\theta}} \tag{35}$$

P^j_t denotes region j's price index for consumption bundle C^j_t, which is normalized to 1. $P_{Bj,t}$ denotes the price index for the goods produced in county j at time t.

$$P_{Bj,t} = \left(\int_0^1 (p_{Bj,t}(i))^{1-\theta} di\right)^{\frac{1}{1-\theta}} \tag{36}$$

Therefore, profit for an intermediate firm i in country j can be written as:

$$\begin{aligned} \pi_{Bj,t}(\omega_{Bj}, \varphi(i), i) &= \left(p_{Bj,t}(i) - \frac{v_{j,t}}{\varphi(i)}\right) y_{Bj,t}(i) \\ &= \left(\frac{v_t^{1-\theta}}{\theta - 1}\left(\frac{\theta}{\theta - 1}\right)^{-\theta}\right) \frac{\varphi_{Bj,t}(i)^{\theta-1}}{\omega_{Bj,t}} (C^h_t + C^f_t) \end{aligned} \tag{37}$$

Asymmetric Financial Markets

I assume that in region f all potential entrants can borrow the same fraction δ^f of their present discount value of future profits to finance the initial set up cost, hence there is no asymmetric financial market in region f, or put it simply all potential entrances in foreign region has the same borrowing ability. However, in the home region, I assume q share of the total potential entrants (SOEs), can borrow δ^{SOEs} fraction and the remaining $(1 - q)$ share of firms (POEs) can borrow δ^{POEs} fraction of their present discount value of future profits. Moreover, the aggregate financial condition at home region is defined as $\delta^h_t = q * \delta^{SOEs}_t + (1 - q) * \delta^{POEs}_t$.

The entry decision rule within each region is the same as in the closed economy, where the potential entrant will only decide to enter if he can make non-negative profit conditional on having sufficient funds to finance the initial fixed investment:

In the foreign region, an agent will enter production if:

$$\delta^f \pi^f_\infty(i) \geq F_{Bf} \tag{38}$$

The reservation rule is when agent is indifferent between entry or not to enter, leads to the reservation productivity (φ_t^{f*}) at time t:

$$\varphi_t^{f*} = \left((\frac{\delta^f z}{F_{Bh}}) \int_t^\infty (v_s^f)^{1-\theta} \omega_{Bf,s}^{-1} (C_s^h + C_s^f) e^{-\int_t^s (r_\mu + \rho) d\mu} ds \right)^{\frac{1}{1-\theta}} \tag{39}$$

where $z = (\frac{1}{\theta - 1})^{1-\theta}$ is a constant, differentiate with respect to time:

$$\dot{\varphi}_t^f = (\frac{\delta_t^f z (v_t^f)^{1-\theta}}{F_{Bf} * (\theta - 1)}) * \omega_{Bf,t}^{-1} * (\varphi_t^f)^\theta (C_t^h + C_t^f) - \frac{r_t + \rho}{(\theta - 1)} \varphi_t^f \tag{40}$$

The equilibrium number of intermediate firms at time t is pinned down by:

$$\omega_{Bf,t} = 1 - G(\varphi_t^{f*}) \tag{41}$$

In the home region it is more interesting, SOEs' entry decisions are characterized by:

$$\delta^{SOEs} \pi^h_\infty(i) \geq F_{Bh} \tag{42}$$

Gives:

$$\dot{\varphi}^{h*}_{\delta^{SOEs},t} = (\frac{\delta^{SOEs} z (v_t^h)^{1-\theta}}{F_{Bh} * (\theta - 1)}) * \omega_{Bh,t}^{-1} * (\varphi^h_{\delta^{SOEs},t})^\theta (C_t^h + C_t^f) - \frac{r_t + \rho}{(\theta - 1)} \varphi^h_{\delta^{SOEs},t} \tag{43}$$

For the remaining $(1 - q)$ POEs the enter decision:

$$\delta^{POEs} * \pi^h_\infty(i) \geq F_{Bh} \tag{44}$$

Gives:

$$\dot{\varphi}^{h*}_{\delta^{POEs},t} = (\frac{\delta^{POEs} z (v_t^h)^{1-\theta}}{F_{Bh} * (\theta - 1)}) * \omega_{Bh,t}^{-1} * (\varphi^h_{\delta^{POEs},t})^\theta (C_t^h + C_t^f) - \frac{r_t + \rho}{(\theta - 1)} \varphi^h_{\delta^{POEs},t} \tag{45}$$

Hence the equilibrium number of firms in home economy is:

$$\omega_{Bh,t} = 1 - q * G(\varphi^{h*}_{\delta^{SOEs},t}) - (1 - q) * G(\varphi^{h*}_{\delta^{POEs},t}) \tag{46}$$

World Asset Market

Similar to the closed economy, each region j's wealth evolves according to:

$$\dot{W}_t^j = r_t W_t^j + A_t^j - C_t^j \tag{47}$$

$$r_t V_t^j = \delta_t \Pi_t^j + \dot{V}_t^j \tag{48}$$

Let, W_t^w denote the world demand for asset or world's total saving; similarly V_t^w denotes the total asset outstanding in the world:

$$W_t^w = W_t^h + W_t^f \tag{49}$$

$$V_t^w = V_t^h + V_t^f \tag{50}$$

The world equilibrium interest rate at time t, is pinned down global asset market clearance condition:

$$V_t^w = W_t^w \tag{51}$$

Finally, I define the current account balance and trade balance:

$$\begin{aligned} CA_t^j &= \dot{W}_t^j - \dot{V}_t^j \\ TB_t^j &= P_{Bj,t} Y_{Bj,t}^z - P_{Bz,t} Y_{Bz,t}^j \quad j, z = h, f; j \neq z \end{aligned} \tag{52}$$

6 Quantitative Analysis

In this section, I investigate whether facts observed both at national and international level: 1, the productivity differential between SOEs and POEs in China; 2, the sustained Chinese current account surplus; and 3, the stubborn decline in long run real interest rate, are results of the co-existence of two different borrowing constraints within the home region. I start the investigation by looking at when a negative shock hits the aggregate financial market in the home region (a fall in both δ_t^{SOEs} and δ_t^{POEs} hence δ_t^h), i.e. a temporary crash in the Chinese financial market or a contraction in monetary policy. I will then layout the core results in the following subsection, where I show how the facts are generated, when the Chinese economy hits by a more 'realistic' asymmetric financial shock such that, SOEs see their credit constraints relaxed at the cost of tightening borrowing constraints for the remaining POEs. Given it is widely accepted that, the aggregate financial condition in China has developed in the past, I show all the results hold still true, even in the case where aggregate credit condition in China is improving, as long as the differences between SOEs' and POEs' borrowing abilities exist, that is δ^h grows but $\delta^{SOEs} > \delta^{POEs}$ i.e. an implementation of expansionary monetary policy to inject more credit in the economy, plus its unintended consequences which lead to a wider gap in borrowing abilities between SOEs and POEs.

6.1 A Calibration

I begin by discussing the parameter calibration in the home region. Preference parameters are standard, for simplicity I assume the inter-temporal elasticity of substitution is same for the final good producer and household's final good

consumption, and it is fixed at $\theta = 2.1$. The time discount factor for the household is set at $\tau = 0.02$ to match the average real interest rate in China between 2002 and 2010[25]. The productivity φ follows Pareto distribution, with shape parameter α equals to 2.6 and the minimum productivity set to equal 0.2, these assumptions follow Corcos, Gatto, Mion and Ottaviano (2009), where they show that Pareto distribution closely fits the observed firm productivity distribution, and using a large firm level dataset from E.U., they estimate share parameter α across different manufacturing industries. The exogenous enter and exit rate is calibrated to 5.5 percent, which was calculated as the (yearly) average of the firm enter and exit in China between 2002 to 2006 from Brandt, Biesebroeck and Zhang[26] (2009). The initial fixed cost (F_B) is set to equal to 0.32 which is calibrated to the ratio between total fixed investments as share of total output across Chinese manufacturing industries. The share of SOEs q, I calibrated to 0.5 to match the average SOEs' output share in 26 manufacturing industries between 2002 and 2007. To make the model more manageable, I assume $f_t(i) = \frac{\pi_t(i)}{\pi_\infty(i)} \frac{F_B}{\delta}$, by making this simplification assumption the number of state variables which I need to keep track of, are significantly reduced. Finally, since it is difficult to measure borrowing constraints directly, I calibrate the value of δ^h indirectly (following Caballero, Farhi and Gourinchas (2008)), to do so I assume the steady state value of r to be around 3 percentage points, which implies a value of $\delta^h = 0.12$.

Given the initial calibrations at home, I now explore a number of scenarios which will lay out the parameter calibrations in the foreign economy.

6.2 A Temporary Borrowing Ability Shock

I start with the analysis of a temporary collapse in δ^h. In order to reveal the impacts and mechanisms of this shock, I make the assumption that both home and foreign regions start at same line or operate at the same steady state prior the shock.

Assumption 1 (Initial Conditions): The world is initially symmetric, more specifically $\delta^h = \delta^{POEs} = \delta^{SOEs} = \delta^f$. Moreover, $F_{Bh} = F_{Bf}$.

Since both regions are initially symmetric, there is no initial net trade and capital flow.

Suppose now, unexpectedly at $t = 0$, δ^h drops temporally to $\delta^{SOEs} =$

[25] Data from World Development Indicator.

[26] Figure 1 in Brandt, Biesebroeck and Zhang (2009), suggests between 2003 and 2006, there are on average 2.75 percent new SOEs, 13.75 percent new POEs enter into and 2.9 percent of SOEs, 5.6 percent of POEs exit from current production. One caveat, some of the new semi-privatized SOEs entrance, enters the production as POEs in the data, this could explain the low SOEs entering rate.

$\delta^{POEs} = \delta^h < \delta^f$. The fall in δ^h in general could result from, a crash in a bubble, a monetary tightening (as I argued before) or a significant loss of informed and intermediation capital.

Note that the definition for current account in this paper excludes, as does the one of national accounts, unexpected valuation effects - unexpected capital gains and losses from international positions. It is not a relevant issue for now, since the only surprise takes place at date 0, when agents are not holding international assets.

Also note that, since $CA_t^h + CA_t^f = 0$, I need only describe one of the current accounts to characterize both. Henceforth, I will focus on describing the behaviour of CA_t^h, with the understanding that this concept describes features of the global equilibrium rather than h-specific features.

Figure 11[27] characterizes the path for some key variables following a collapse of δ^h calibrated so that h's investment level drops by just above 25 percent relative to the steady state value. Panel A (CA) shows that h's current account exhibits an initial surplus of 1.6 percent of GDP. This sharp and concentrated initial spike may be partly due to the lack of smoothing mechanism in the model. Still, note that in this fast environment, current account surplus does not disappear after 2 time periods. The main driver behind, is the gap between home saving rates and home asset issuance rates. The interest rate drops by more than 5 percent before rising back to its original steady state value of 2.9 percentage points.

In summary, the model is able to generate, simultaneously, a large current account surplus and a decline in real interest rate which are consistent with Caballero, Farhi and Gourinchas (2008).

6.3 An Asymmetric Borrowing Abilities Shock and Trend I

Given that the aggregate credit condition has improved in EMs, especially in China, it is difficult to reconcile any facts as the consequences of a collapse in financial market. Therefore, in this subsection, I consider a temporary credit shock in the home region, such that one set of firms (POEs) became harder to borrow, and the remaining firms (SOEs) became easier to borrow at the same magnitude, most importantly the aggregate credit condition remains unchanged after the shock, that is, δ^{SOEs} increases, δ^{POEs} decreases but δ^h remain unchanged[28]. As mentioned in earlier section, the empirical evidences revealed an

[27] Note: each of the graphs plots the response of a variable as a percentage deviation from its steady state value after the shock, unless otherwise stated.

[28] I define an asymmetric borrowing abilities shock is a shock, such that after the shock POEs became harder to borrow and SOEs became easier to borrow, however I make no assumption

important trend in the Chinese economy. Namely, SOEs consistently had better access to credit market relative to POEs. Therefore, I consider two cases, firstly I assume prior to the shock, both SOEs and POEs have the same borrowing abilities ($\delta^{SOEs} = \delta^{POEs}$), hence all the results are driven by firm's endogenous entry decision, it is important as these decisions collectively affect the aggregate profit levels in the economy; secondly, I incorporate the trend $\delta^{SOEs} > \delta^{POEs}$ into the main mechanism, in particular I assume SOEs on average can borrow 40 percent (a number calculated from annual Chinese loan issuance data) more relative to POEs.

One caveat, standard models imply that capital flows from low to high growth economies; I argue here that this conclusion does not carry over to the case where productive agents have limited ability to generate assets in order to carry out investment. In particular, high productivity combined with low ability to generate asset in the home region imply greater savings which in turn lower long-run interest rates and generate large capital outflow.

Assumption 2 (Initial Conditions): The world is initially symmetric, with $\delta^h = \delta^f$. Moreover, prior to the shock, SOEs and POEs have the same borrowing abilities $\delta^{SOEs} = \delta^{POEs}$ and $F_{Bh} = F_{Bf}$.

Figure $12 - 14$[29] illustrate the entire path following the asymmetric shock in the home economy. I explore the transmission paths in detail:

Immediately after the shock, SOEs' borrowing ability rise at the cost of fall in POEs' borrowing ability, where the aggregate credit condition remains unchanged in the home region (see Panel 1, 2 and 3). The reservation productivity for POEs to enter production becomes higher (see Panel 5), whereas the reservation productivity for SOEs (Panel 4) falls due to better access to credit market. Furthermore, since a firm's profit level is positively correlated with its market share, SOEs deter the marginal POEs enter into production (competition effect); this creates a second order effect[30] which forces only the 'super' productive POEs can enter and survive in the intermediate good production. Most importantly, this competition effect leads to a higher increase in averaged POEs' productivities than the fall in averaged SOEs' productivities, hence the net aggregate productivity at home region increases (see Panel 6).

The equilibrium number of POEs falls and SOEs rises, as shown in Panel 7 and 8, and aggregate number of intermediate good producers increase, due to a large number of SOEs enter by taking advantages of the better access to credit

on the aggregate borrowing condition, as you shall see the reason later.

[29] Note: each of the graphs plots the response of a variable as a percentage deviation from its steady state value after the shock, unless otherwise stated.

[30] Although the effect is second order, as this paper shows its impact on shaping global equilibrium is large in magnitude, therefore it is important to understand the mechanisms behind this effect.

market (see Panel 9).

The intermediate good price level is inversely related to its producer's productivity level, hence the average price of POEs produced intermediate outputs fall, and vice versa for the intermediate output produced by SOEs. The final good producer sets the final good price as its marginal cost, since the aggregate cost of intermediate input falls due to more productive POEs (the competition effect, see Panel 10 and 11) the price of home produced final goods fall (see Panel 12). This leads to an improvement of the trade balance in the home region (see Panel 15).

Furthermore, an intermediate firm's profit level is positively related to its productivity level, as shown in Panel 13 and 14, POEs see their profits rise and a fall in SOEs' profit level.

Higher profit level translates to a higher consumption level and saving rate for the households who own POEs (see Panel 17 and 20), and the opposite story is true for SOEs owners (see Panel 16 and 19). The key message here is that the rise in average POEs' productivity is higher than the fall in average SOEs' productivity due to competition effect at the enter to production stage. Therefore the aggregate consumption level and saving rate rise in home region (see Panel 18 and 21).

In the home region, POEs owners drive the high saving rate due to larger profit levels, and SOEs become the drivers behind the high investment rate due to better access to credit, as confirmed in Panel 20 and 22. Hence, SOEs are the main drivers behind the new asset issuance in the home region.

However, the average productivity level of SOEs is lower relative to POEs' average, since saving rate is driven by POEs (see Panel 20), and the new asset issuance rate is driven by SOEs (see Panel 22). The aggregate saving rate increases (see Panel 21), and the aggregate new asset issuance falls (see Panel 25). As a result, capital flows from home to foreign region, as Panel 26 shows.

As the final good produced in the home region is a close substitute for the foreign produced final good, foreign final good output level is downsized as shown in Panel 27 (households substitute their consumption in foreign produced final goods with the cheaper final output produced by the home region). This environment leads to a fall in aggregate profit level and saving rate in foreign region (see Panel 28 and 29). However, the foreign households' consumption levels do not fall as much, since they are taking advantages of the cheaper import from the home region (see Panel 30).

Furthermore, the higher consumption levels in the home region (together with the lower world interest rate) increases the demand for foreign produced final goods. This increase in demand for foreign produced final goods, translates

into a higher number of intermediate good producers, as a result the new asset issuance increases in the foreign region (see Panel 31).

The saving accumulated by POEs owners in searching for investable assets, drives up the world saving rate at the same time new investable asset from the foreign region leads to an increase in world asset supply. These observations have two consequences: 1, a large capital outflows from home to foreign region; 2, the world equilibrium interest rate falls (see Panel 26 and 34). This fall in interest rate feeds back to encourage more investment and consumption in both regions. Therefore the final good output in home region rises, this increase is partly driven by the external demand from foreign region (see Panel 35). Furthermore, the rise in home produced final output is also driven by an internal factor - the re-allocation of labour towards the more productive POEs within the home region, since there are no job searching nor matching frictions, labour can easily switch between jobs. Finally, wage rate in home region rises (see Panel 36).

Overall, this asymmetric borrowing abilities shock is able to generate: 1, a productivity differential between SOEs and POEs; 2, a large current account surplus in home region; and 3, a fall in world equilibrium interest rate.

In Figure $15-17$[31], the green lines represent the path with the initial conditions where SOEs have better borrowing ability than POEs i.e. $\delta^{SOEs} > \delta^{POEs}$, in particular I assume SOEs can on average borrow 40 percent more relative to POEs. The blue lines represent the same results as before, where initially SOEs and POEs have the same borrowing abilities. These results suggest that by incorporating the trend into the main mechanism, all the impacts point to the same direction, and the trend amplifies the propagation mechanism, lead to larger impact on all variables.

6.4 An Asymmetric Borrowing Abilities Shock and Trend II

In this subsection, I deliberately used the same title as the previous one, since I also show the main mechanism interacts with a trend, but with a trend that the financial market has been on the path of development during past years. The term financial market development refers to the case where the aggregate borrowing ability at time s is 'better' relative to previous period t i.e. $\delta_s^h > \delta_t^h$ and $s > t$. In particular, I consider an asymmetric borrowing abilities shock, such that after the shock SOEs increase their borrowing abilities and POEs see their borrowing abilities decrease, where the aggregate credit condition has improved after the shock ($\delta_s^h > \delta_t^h$)[32]. Additionally, I consider two more cases, where

[31] Note: each of the graphs plots the response of a variable relative to its steady state value after the shock, unless otherwise stated.

[32] s refers to a time after the shock and t refers to a time period before the shock.

the aggregate credit condition remain unchanged ($\delta_s^h = \delta_t^h$) and the aggregate credit condition weakened ($\delta_s^h < \delta_t^h$). The results of these experiments pose two important messages. Firstly, financially market development can not correct the distortions caused by a asymmetric borrowing abilities shock. In particular when the financial market is growing at a 'slow' rate, all model implied results on productivity differential between SOEs and POEs in China; large Chinese current account surplus and decline in world equilibrium interest rate still exit after the asymmetric borrowing abilities shock. Secondly, the results under all three different cases (see Figure $18 - 20$[33], where the green lines correspond to a financial market improvement (case 1), the blue lines correspond to an unchanged aggregate financial condition (case 2) and lastly, red lines correspond to a collapse of the financial market (case 3) after the shock.) are pointing to the same direction, suggests that the aggregate financial market condition is just a sideshow when asymmetric borrowing constraints co-exit within one region.

7 Conclusion

In this paper, I proposed a framework to analyze the impact of financial market shocks on productivity differential, trade balance, capital flow and equilibrium interest rate. The framework highlights the central role played by the co-existence of asymmetric borrowing abilities within an economy.

I use this framework to discuss different financial shocks and their interaction with macroeconomic trends which I think are particular important in explaining both the facts at the national level - productivity differential in China, and some observations at the global level such as the global imbalances and long run interest rate conundrum. A few examples of the shock can be a sudden tightening of monetary policy to control both the quality and the quantity of new credit issuance, in particular the implementation of "Window Guidance", where the trend is the secular process of a country's policy. These shocks all pointed to the same direction: a force (competition effect) leads to only "super" productive POEs (firms with low credit access) to enter the production, a re-allocation of savings toward advanced economies and a fall in world equilibrium interest rate.

The framework is flexible enough to explore a variety of different situations that have been postulated in both the growth literature and the global imbalances debate. For example, in this model the aggregate productivity growth in China is driven by the new POEs entrance, which is consistent with the findings in Brandt, Biesebroeck and Zhang (2009). The model is also able to replicate the results in Caballero, Farhi and Gourinchas (2008), their main argument is the inability to supply financial assets, whereas in this paper I argue it is the gap between saving rate and investment rate caused by productivity differential between POEs and SOEs. Furthermore this productivity differential is the result of

[33]Note: each of the graphs plots the response of a variable relative to its steady state value after the shock, unless otherwise stated.

SOEs and POEs compete to begin production under asymmetric financial markets, where this competition effect was largely ignored by the existing literature.

There are many extensions that can be done based on this basic structure, for example a better model of households' labour supply decisions and labour market searching and matching frictions will help to generate smoother version of the output dynamic. Secondly, there are no robust borrowing decisions after firms have entered the production, the reason it was not included in this paper is I want to emphasize the importance of credit constraint on firms' entry decisions in shaping the industrial composition. Thirdly, the high growth rate in EMs was not incorporated into the model. However, since the key driver in this paper is the asymmetry between SOEs and POEs, by allowing both SOEs and POEs to grow will not change the main results, moreover, high growth rate will only enlarge the already existed asymmetries. Lastly, one interesting extension is to allow households use their savings to finance the initial fixed entry cost, this will generate another motivation for the credit constrained households to save, hence a larger current account surplus is expected.

This paper poses a key message for the Chinese policy makers - they must pay attention, and more importantly to avoid the unintended consequences on credit allocation, when they carry out policy implementations. As this paper shows these "side-effects" do not only distort the Chinese economy but world economic equilibrium. The suggestion for the Chinese policy makers is three fold: 1, they should 'stop' the state-controlled commercial banks discriminate POEs from the loan market; 2, they should encourage a healthy development of an alternative funding markets such as public bond and equity markets (as these markets could potentially un-do the distortion in the loan market); finally 3, but more importantly, they must develop a robust credit assessment system (which provides accurate assessment of POEs' credit worthiness to the commercial banks).

A word of caution - this paper highlights that the current configuration of both within and global asymmetry is likely to continue building on the already large net external imbalances. As this paper suggests, the potential policy tools to tackle the problem of global imbalances should not only focus on a conventional toolbox such as exchange rate regimes. Finally, one of the main messages, especially for the world policy makers has been that such risk does not follow as an unavoidable outcome of the current configuration in global imbalances, as the latter are consistent with asymmetries in financial development within a country rather than across it.

References

[1] Allen Franklin, Jun Qian and Meijun Qian. 2008 *China's Financial System: Past, Present and Future*, China's Great Economic Transformation Loren Brandt and Thomas Rawski ed., pp.569−632. Cambridge University Press.

[2] Amaral S. Pedro and Erwan Quintin. 2010 *Limited Enforcement, Financial Intermediation and Economic Development: A Quantitative Analysis*, International Economic Review, 51(3), 785 − 811.

[3] Bacchetta Philippe and Kenza Benhima. 2010 *The Demand for Liquid Assets, Corporate Saving, and Global Imbalance*, mimeo.

[4] Batra Geeta, Daniel Kaufmann and Andrew H.W. Stone. 2003 *Investment Climate around the World: Voices of Firms from the World Business Environment Survey.* Washington, DC: World Bank.

[5] Blanchard J. Olivier. 1985 *Debt, Deficits, and Finite Horizons.* Journal of Political Economy, University of Chicago Press, vol. 93(2), pages 223−47.

[6] Brandt Loren, Johannes Van Biesebroeck and Yifan Zhang. 2009 *Creative Accounting or Creative Destruction? Firm-Level Productivity Growth in Chinese Manufacturing.* NBER Working Paper Series 15152, National Bureau of Economic Research.

[7] Brandt Loren, Chang-Tai Hsieh and Xiaodong Zhu. 2008 *Growth and Structural Transformation in China.* China's Great Economic Transformation Loren Brandt and Thomas Rawski ed., pp.569 − 632. Cambridge University Press.

[8] Brandt Loren and Xiaodong Zhu. 2010 *Account for China's Growth.* IZA Discussion Papers 4764, Institute for the Study of labour.

[9] Buera J. Francisco, Joseph Kaboski and Yongseok Shin. 2009 *Finance and Development: A Tale of Two Sectors* NBER Working Paper Series 14914, National Bureau of Economic Research.

[10] Buera J. Francisco and Yongseok Shin. 2010 *Productivity Growth and Capital Flows: The Dynamics of Reforms.* NBER Working Paper Series 15268, National Bureau of Economic Research.

[11] Buera J. Francisco and Yongseok Shin. 2010 *Financial Frictions and the Persistence of History: A Quantitative Explanation.* NBER Working Paper Series 16400, National Bureau of Economic Research.

[12] Caballero J. Ricardo, Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2006 *An Equilibrium Model of "Global Imbalances" and Low Interest Rate.* NBER Working Paper Series 11996, National Bureau of Economic Research.

[13] Coeurdacier Nicolas, Stephane Guibaud and Keyu Jin. 2011 *Credit Constraints and Growth in a Global Economy.* mimeo LSE

[14] Corcos Gregory, Massimo Del Gatto, Giordano Mion and Gianmarco I.P. Ottaviano. 2009 *Productivity and Firm Selection: Quantifying the 'New' Gains from Trade* FEEM Working Papers 379 and KITeS Working Paper 02/2009.

[15] Dollar David and Shang-Jin Wei. 2007 *Das(Wasted) Kapital: Firm Ownership and Investment Efficiency in China.* NBER Working Paper Series 13103, National Bureau of Economic Research.

[16] Dooley Michael and Peter Garber. 2005 *Is it* 1958 *or* 1968*? Three Notes on the Longevity of the Revived Bretton Woods System.* Brookings Papers on Economic Activity, 36, issue 1, $147 - 210$.

[17] Dooley Michael, David Folkerts-Landau and Peter Garber. 2003 *An Essay on the Revived Bretton Woods System.* NBER Working Paper 9971, National Bureau of Economic Research.

[18] Gregory Neil and Stoyan Tenev. 2001 *The Financing of Private Enterprise in China.* Finance and Development $38 : 14 - 17$.

[19] Greenwood Jeremy, Juan Sanchez and Cheng Wang. 2010 *Quantifying the Impact of Financial Development on Economic Development.* mimeo

[20] Hopenhayn Hugo. 1992 *Entry, Exit, and Firm Dynamics in Long Run Equilibrium.* Econometrica, $60, 1127 - 1150$.

[21] Hsieh Chang-Tai and Peter J. Klenow. 2009 *Misallocation and Manufacturing TFP in China and India.* Quarterly Journal of Economics, 124(4): $1403 - 48$.

[22] Huang Yasheng. 2003 *Selling China: Foreign Investment during the Reform Era.* New York, Cambridge university press.

[23] Islam Nazrul, Erbiao Dai, and Hiroshi Sakamoto. 2006 *Role of TFP in China's Growth.* Asian Economic Journal, $20(2) : 127 - 59$.

[24] Jeong Hyeok and Robert M. Twonsend. 2005 *Sources of TFP Growth: Occupational Choice and Financial Deepening.* Economic Theory, $32(1), 179 - 221$.

[25] Matsuyama Kiminori. 2007 *Credit Traps and Credit Cycles.* American Economic Review 97(1), $503 - 516$.

[26] Mendoza G. Enrique, Vincenzo Quadrini and Jose-Victor Rios-Rull. 2009 *Financial Integration, Financial Development and Global Imbalances.* Journal of Political Economy, 117(3).

[27] Moll Benjamin. 2010 *Productivity Losses from Financial Friction: Can Self-Financing Undo Capital Misallocation.* Princeton University manuscript.

[28] Melitz Marc, 2003 *The Impact Of Trade On Intra-industry Reallocations and Aggregate Industry Productivity.* Econometrica, $71, No.6.1695 - 1725$.

[29] Midrigan Virgiliu and Daniel Yi Xu. 2010 *Finance and Mis-allocation Evidence from Plant-Level Data.* NBER working Paper Series 15647, National Bureau of Economic Research.

[30] Riedel James, Jing Jin and Jian Gao. 2007 *How China Grows: Investment, Finance and Reform.* Princeton and Oxford: Princeton University Press.

[31] Tamim Bayoumi, Hui Tong and Shang-Jin Wei. 2010 *The Chinese Corporate Savings Puzzles: A Firm-level Cross-country Perspective.* NBER Working Papers 16432, National Bureau of Economic Research.

[32] Sandri Damiano. 2010 *Growth and Capital Flows and Risky Entrepreneurship.* Working Paper 10/37, International Monetary Fund.

[33] Shih Victor. 2004 *Factions Matter: Personal Networks and the Distribution of Bank Loans in China.* Journal of Contemporary China, $13 : 38, 3 - 19$.

[34] Song Zheng, Kjetil Storesletten and Fabrizio Zilibotti. 2011 *Growing Like China.* American Economics Review, $101, 202 - 241$.

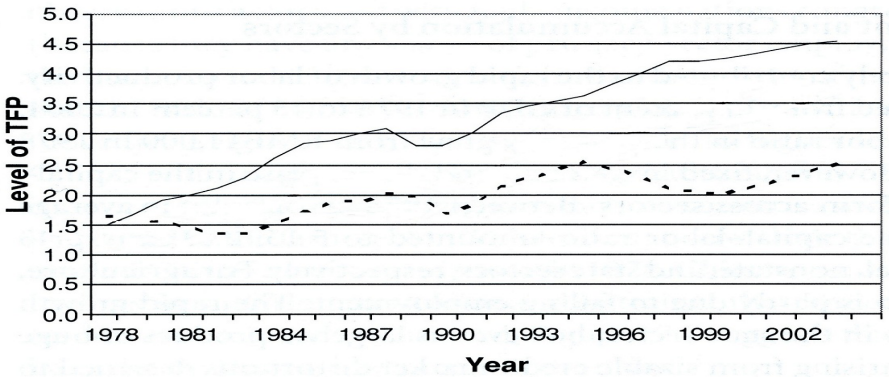

Figure 1: TFP Levels (Dotted Line = the aggregate SOEs TFP Level; Solid Line = the aggregate POEs TFP Level (Loren, Hsieh and Zhu (2008)))

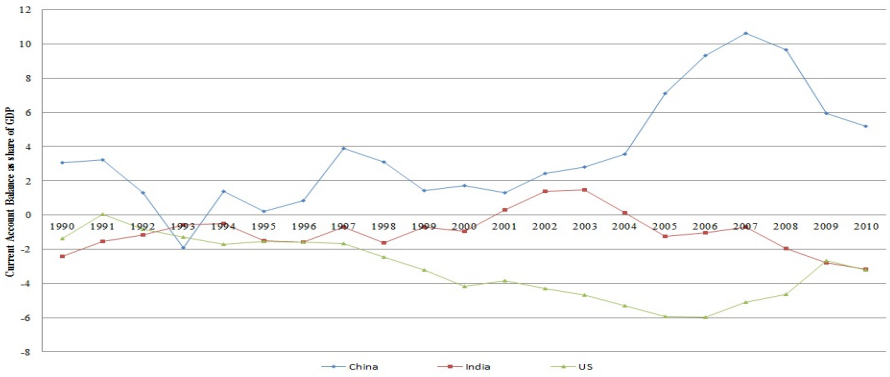

Figure 2: Current Account Balances

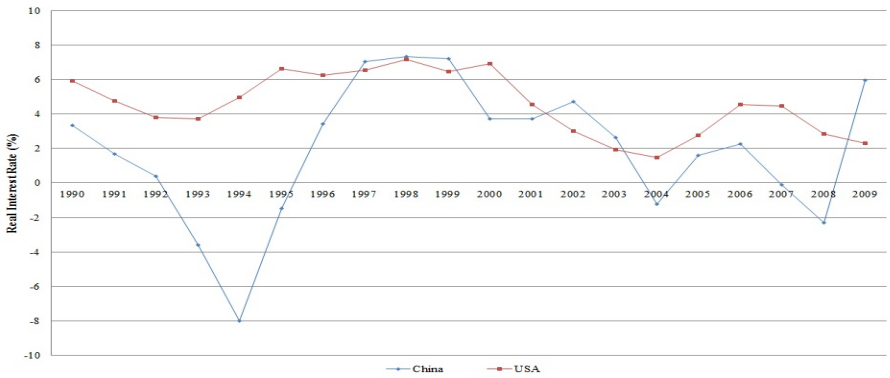

Figure 3: Real Interest Rate

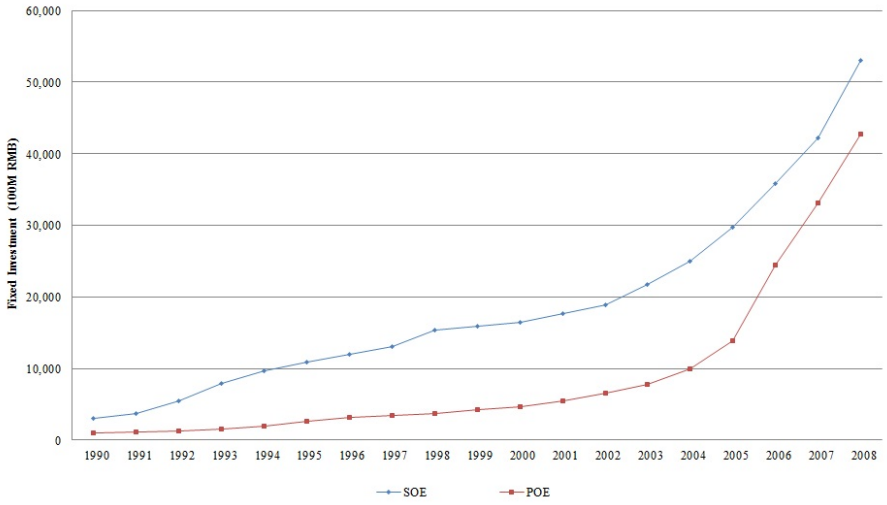

Figure 4: Fix Capital Investment between SOEs and POEs in China

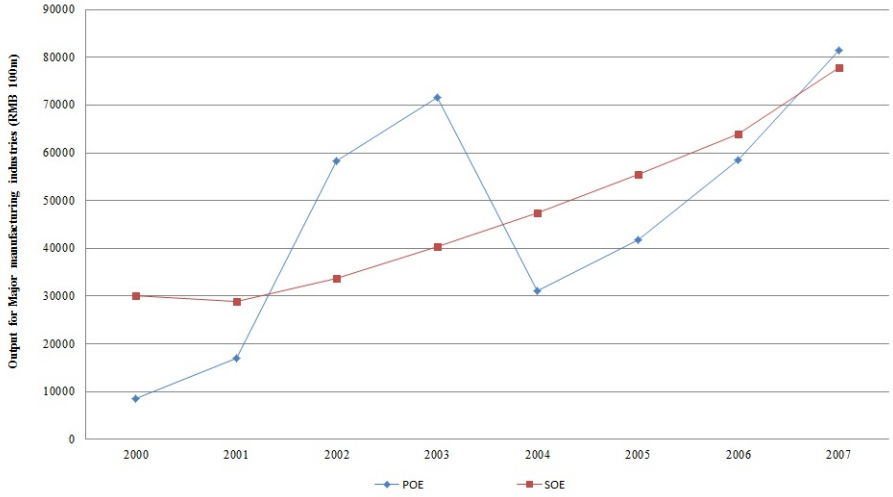

Figure 5: Total Output in Manufacturing Sector between SOEs and POEs in China

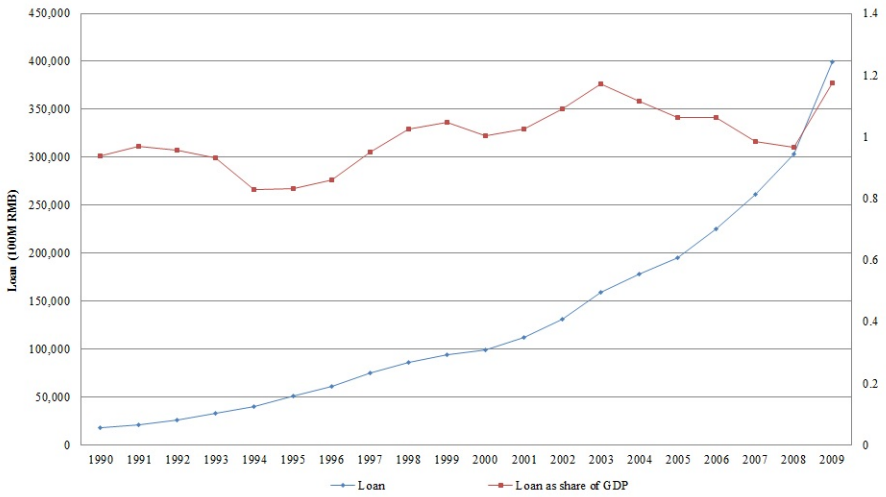

Figure 6: Loan Balance by end of Year in China

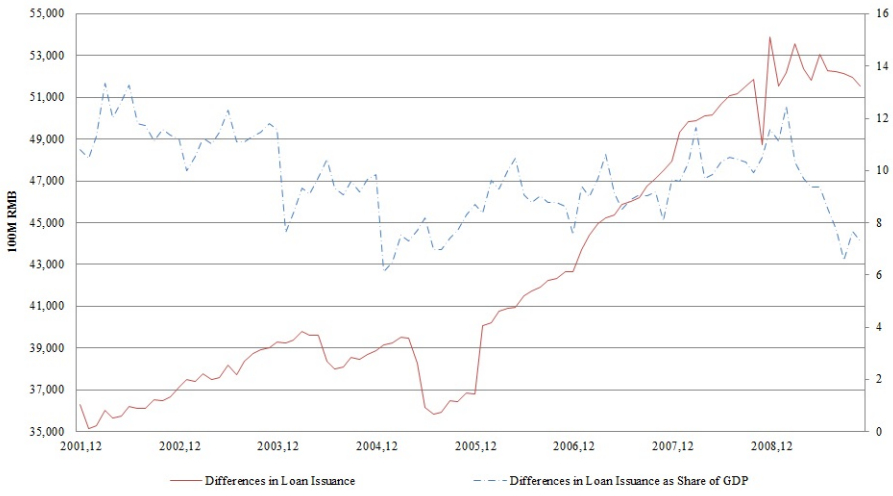

Figure 7: Differences Between SOEs' and POEs' Loan Issuance in China

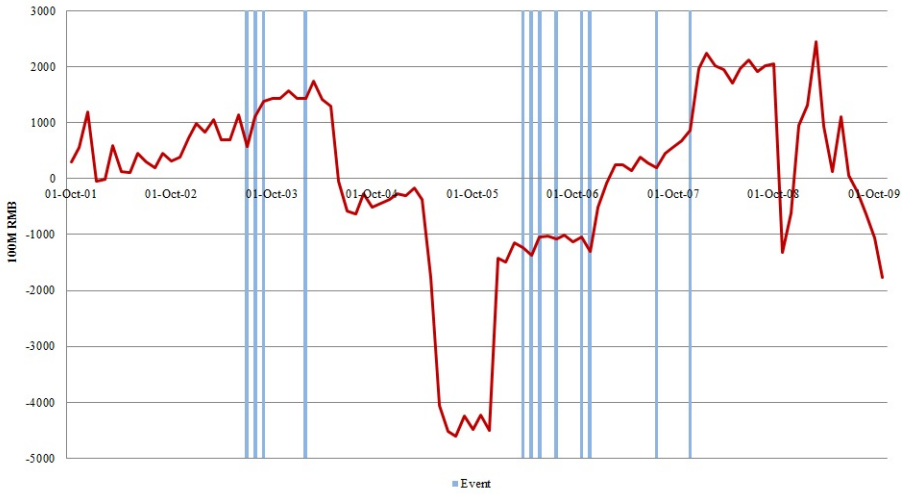

Figure 8: De-trended Differences (between SOEs' and POEs') Loan Issuance and the Event in China

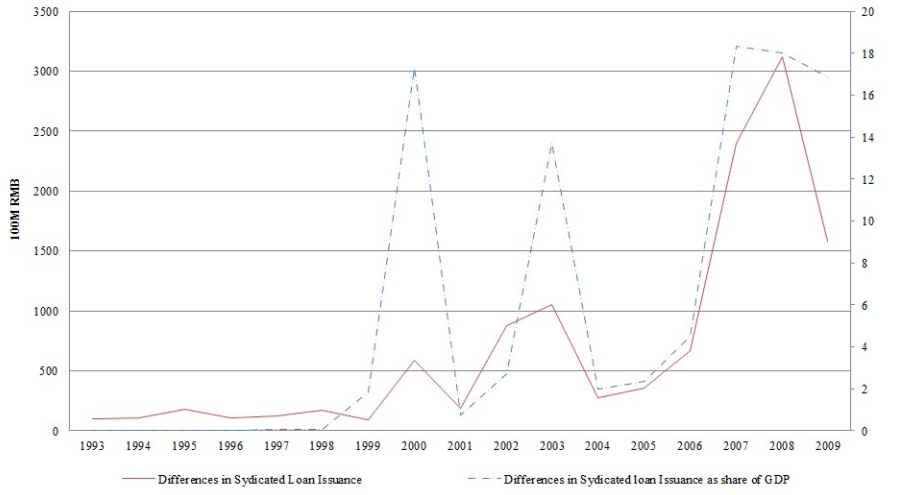

Figure 9: Differences Between SOEs' and POEs' Syndicated Loan Issuance in China

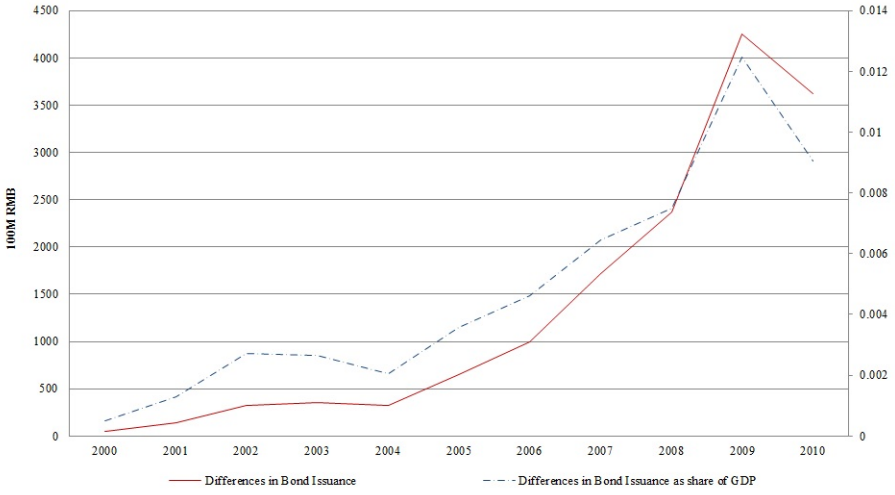

Figure 10: Differences between SOEs' and POEs' Bond Issuance in China

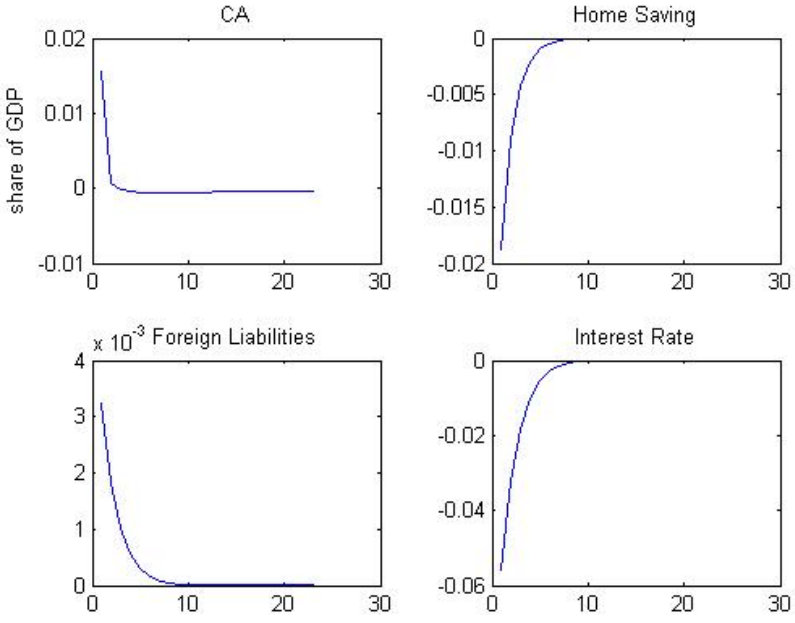

Figure 11: Equilibrium Path after a Borrowing Ability Shock

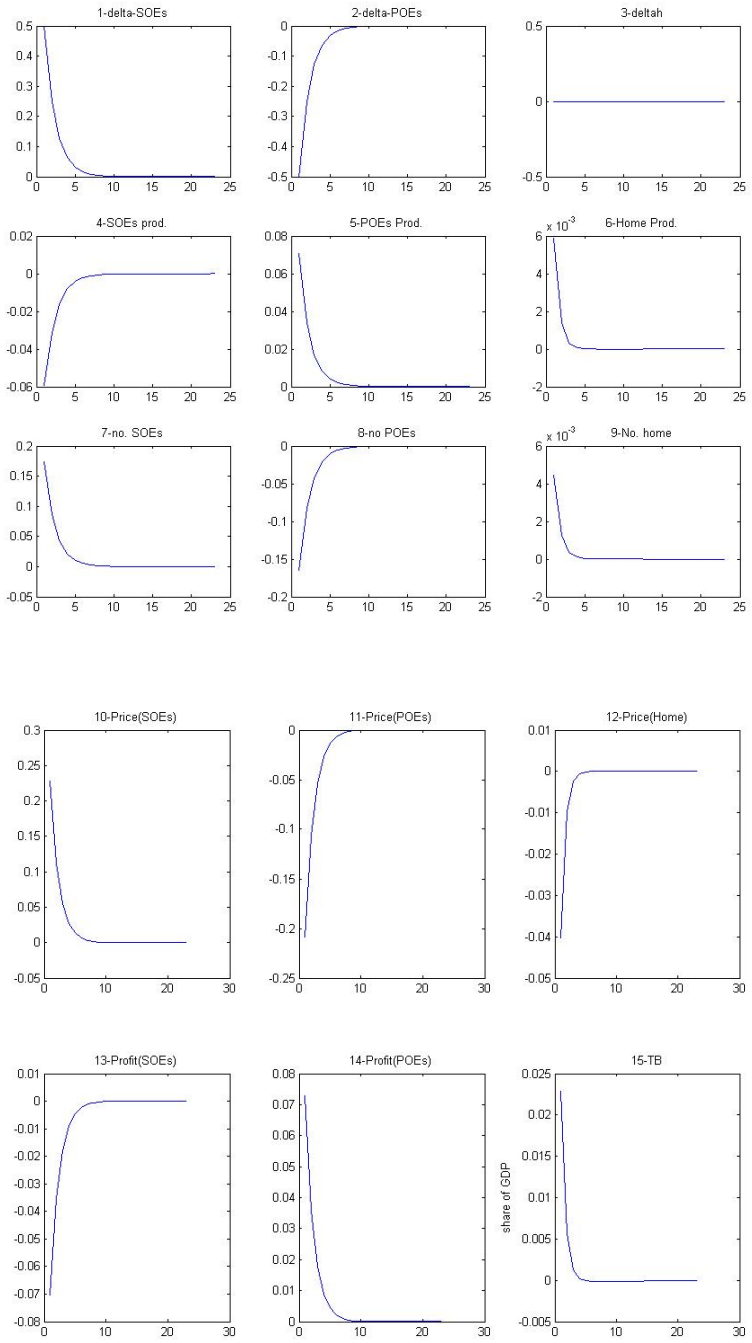

Figure 12: Equilibrium Path after an Asymmetric Borrowing Shock 1

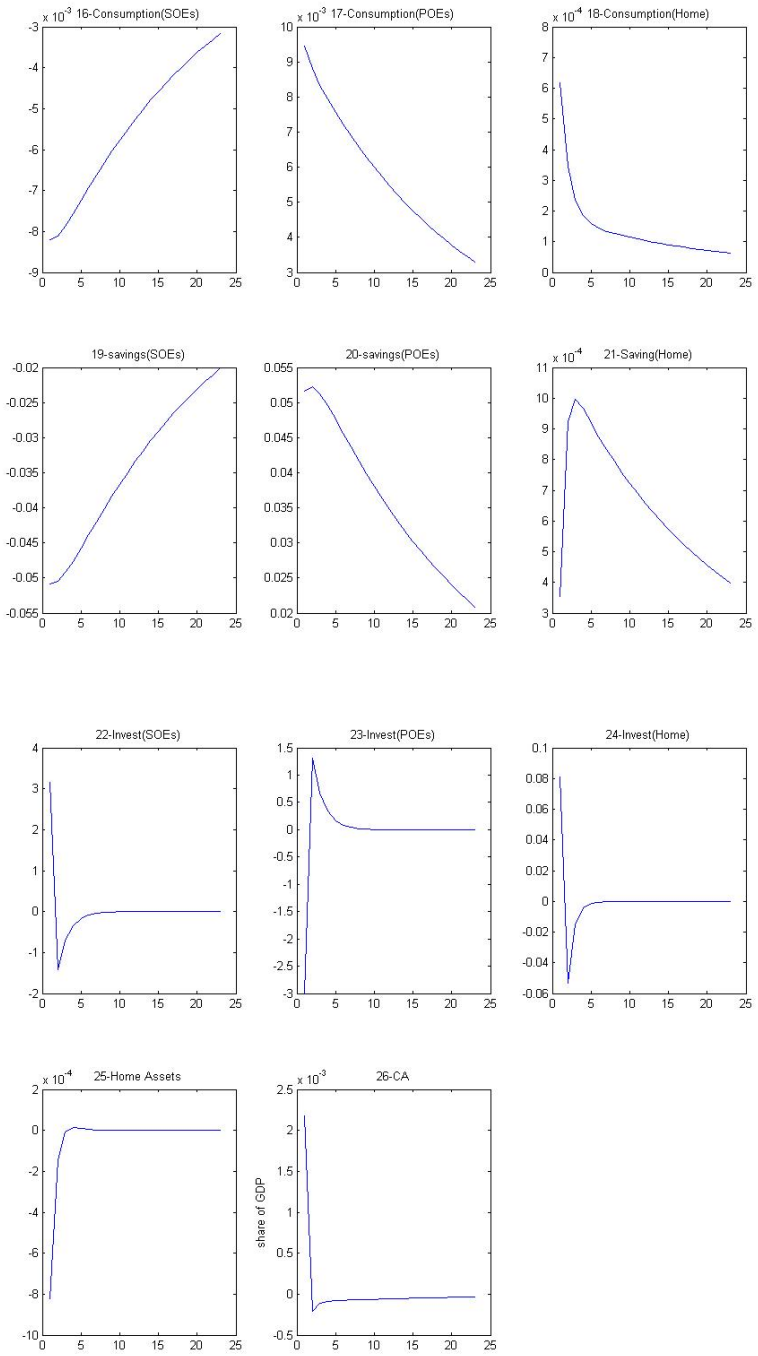

Figure 13: Equilibrium Path after an Asymmetric Borrowing Shock 2

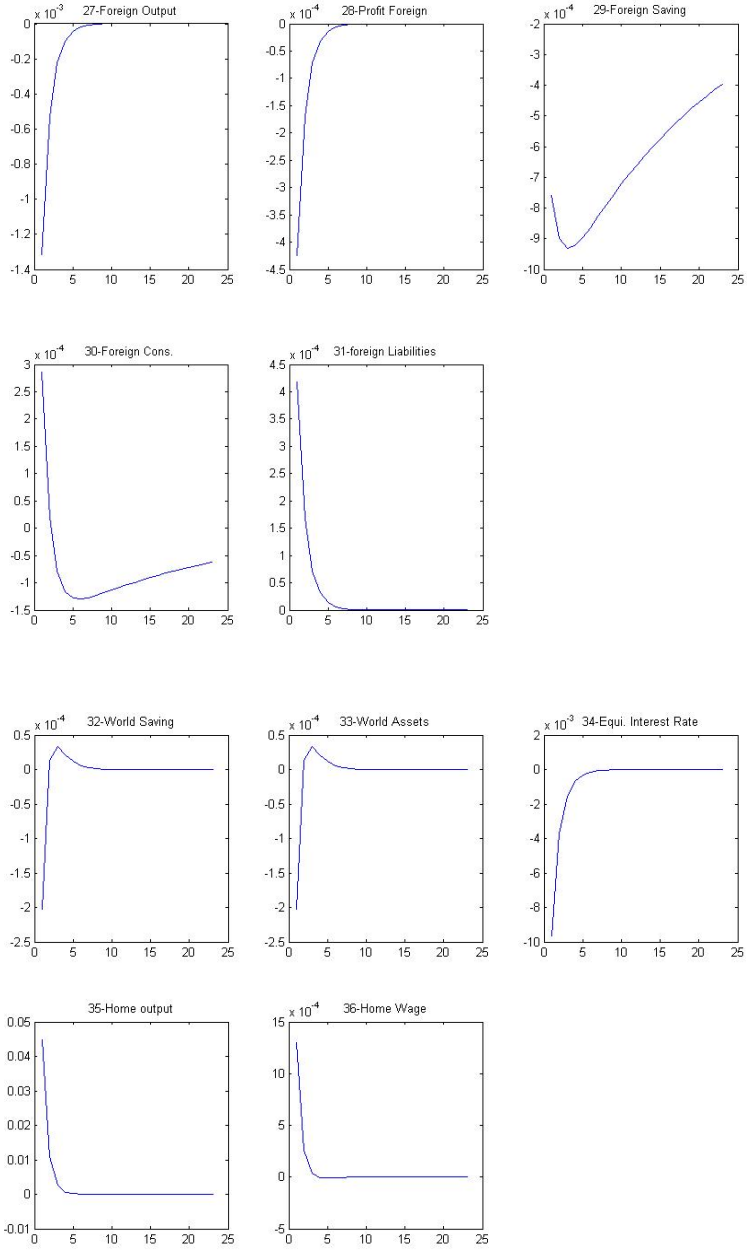

Figure 14: Equilibrium Path after an Asymmetric Borrowing Shock 3

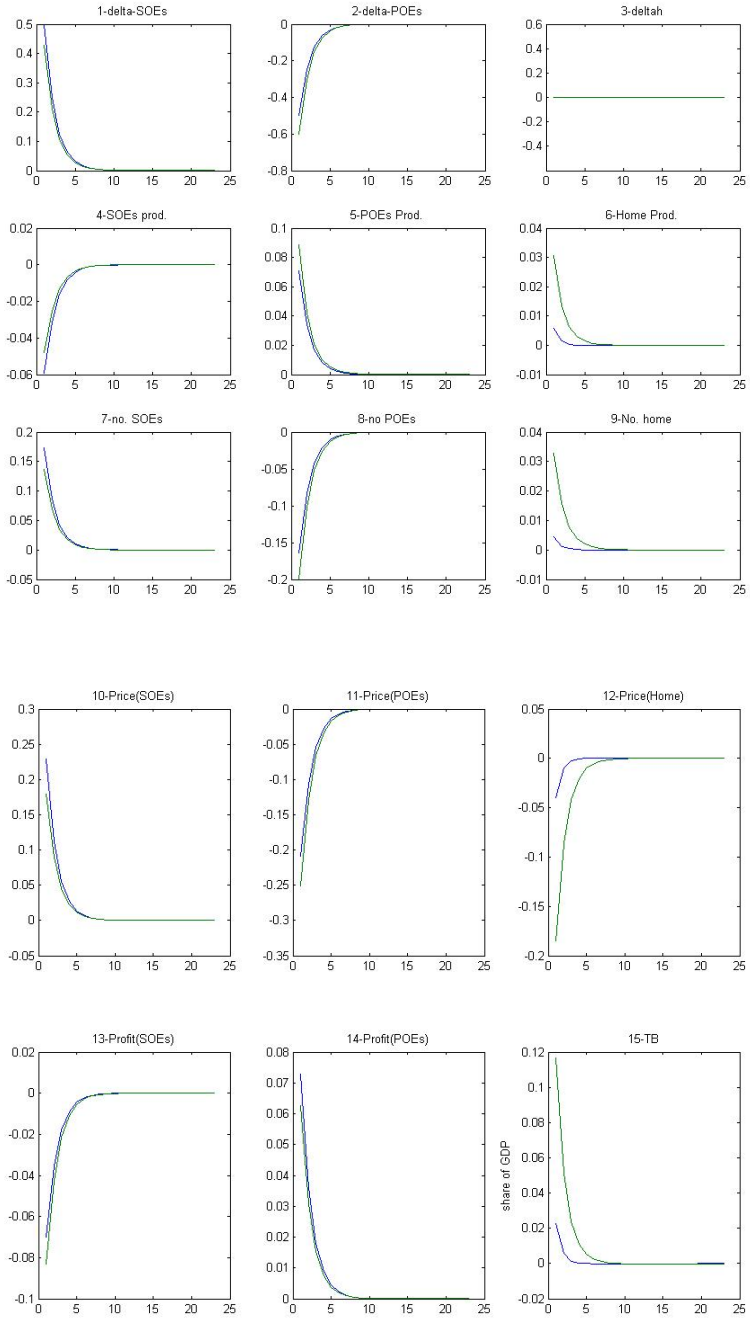

Figure 15: Trend vs No-Trend

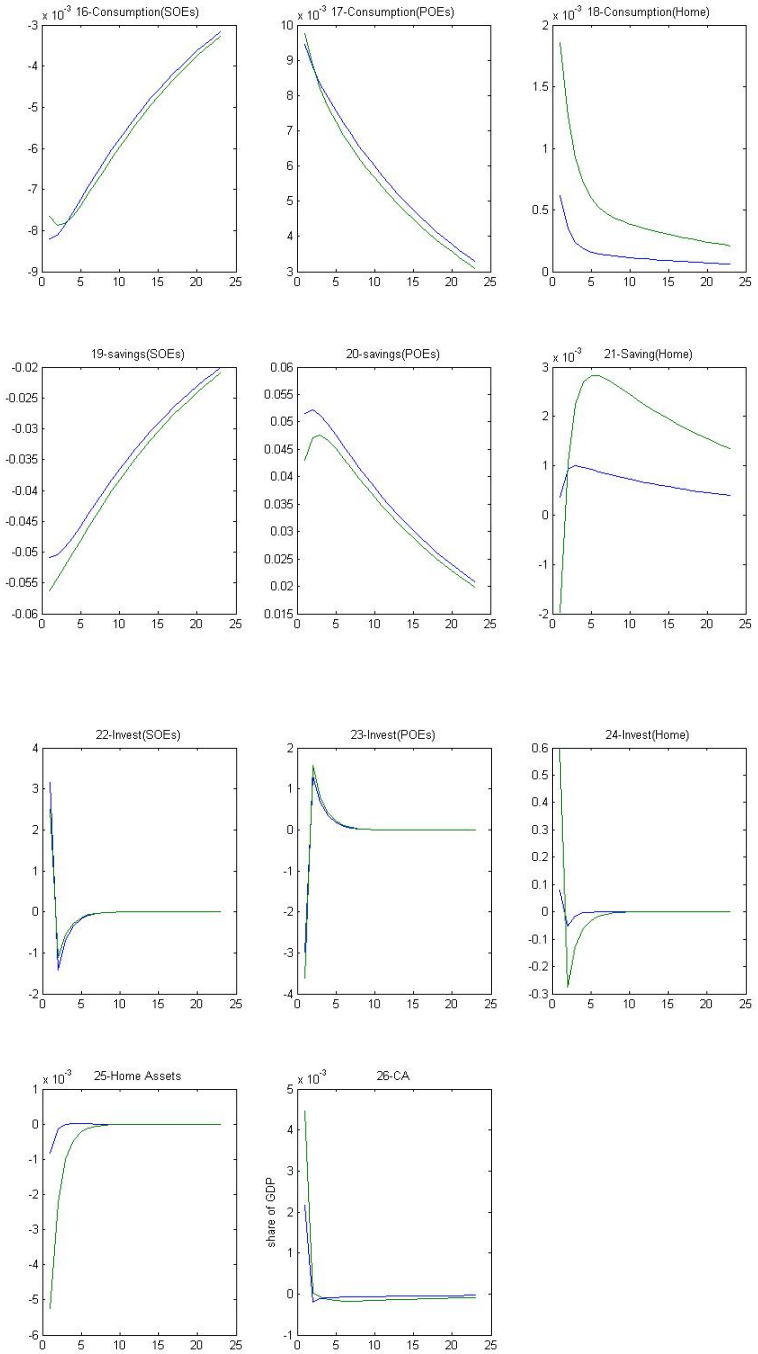

Figure 16: Trend vs No-Trend

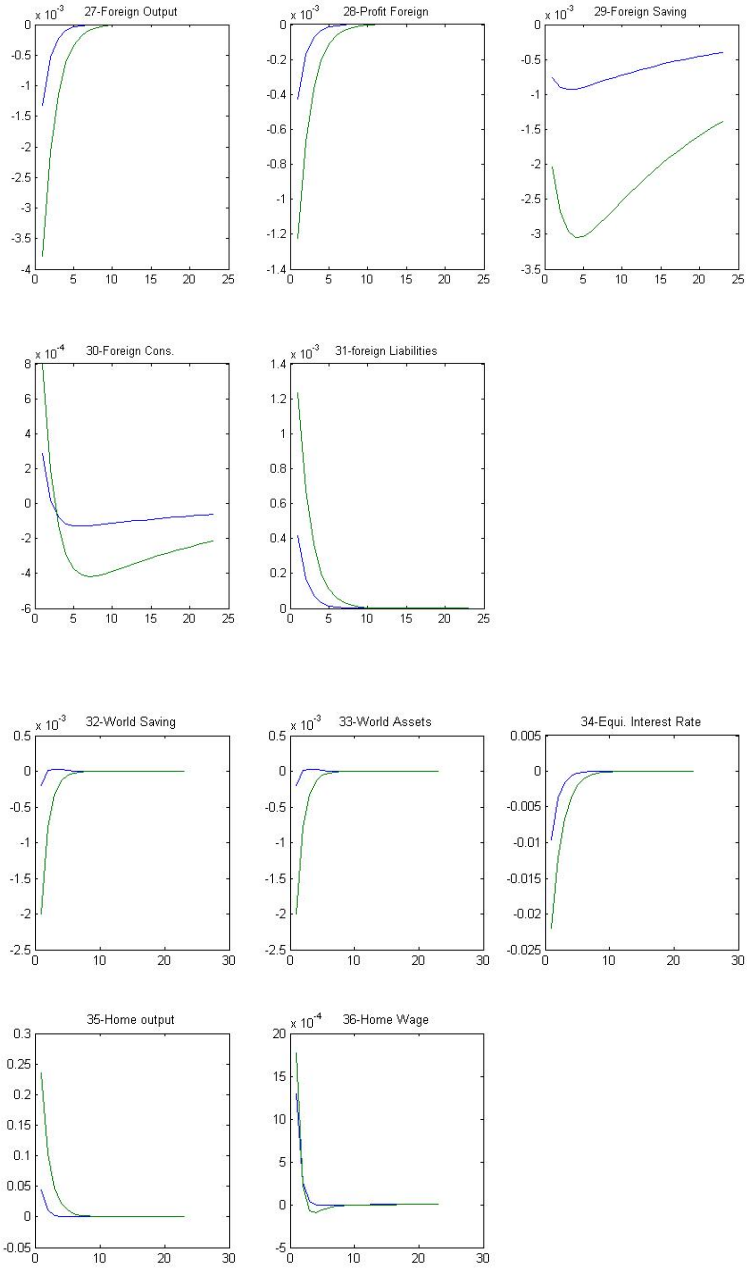

Figure 17: Trend vs No-Trend

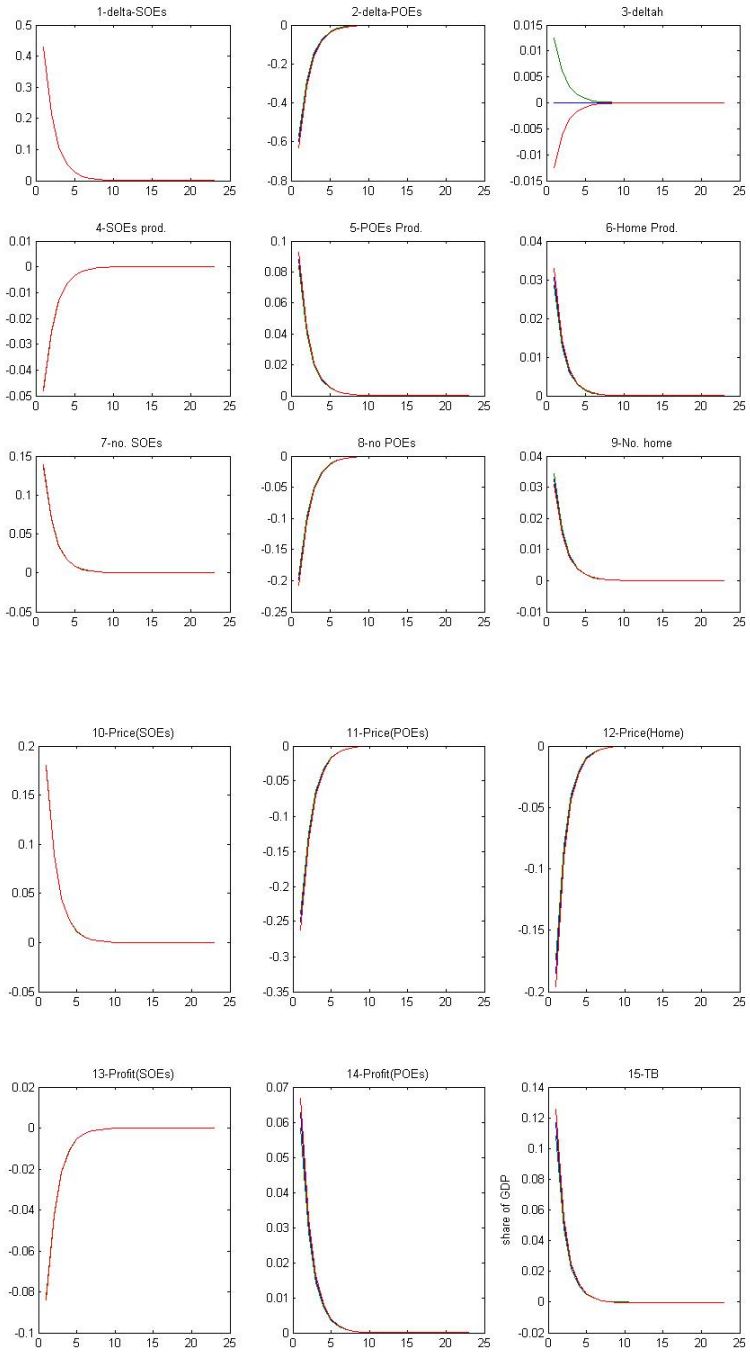

Figure 18: 3 Cases

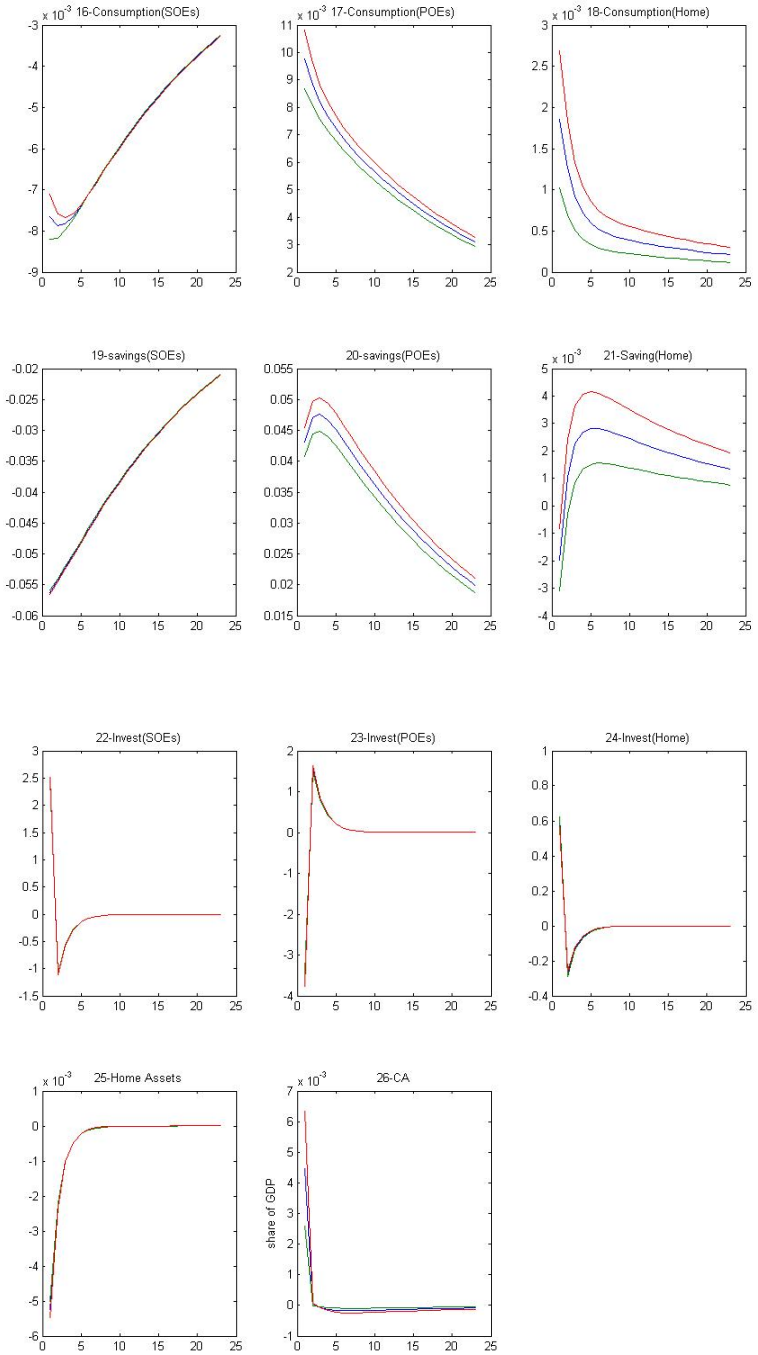

Figure 19: 3 Cases

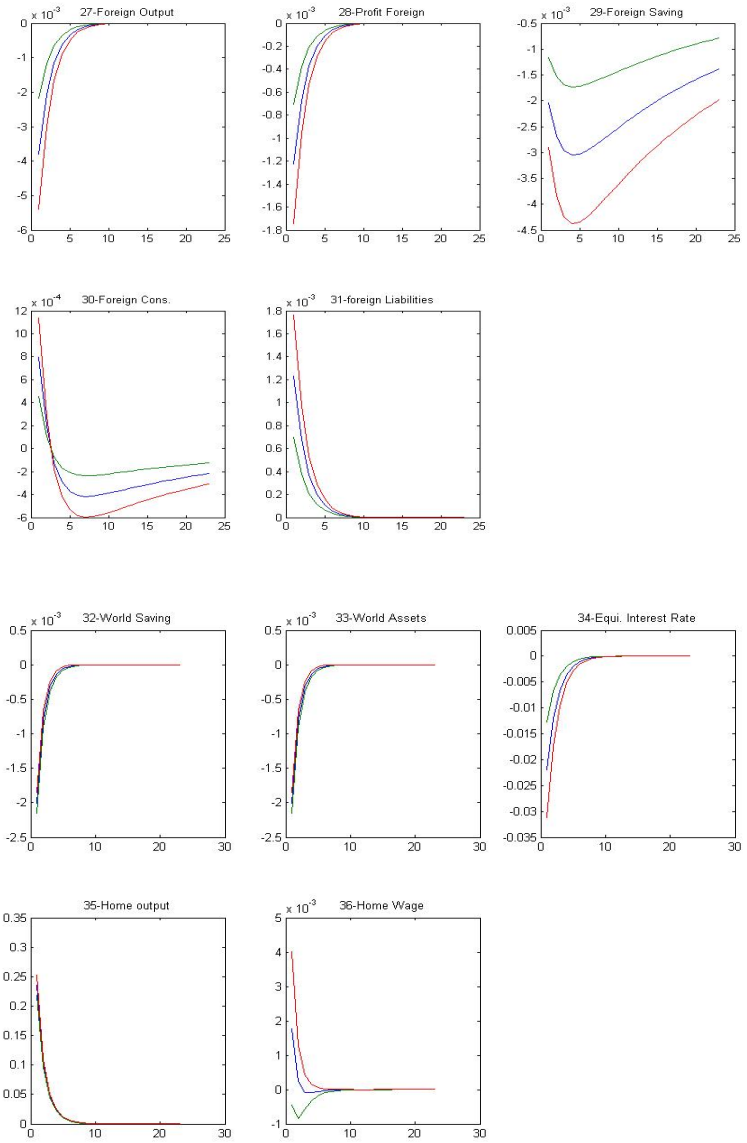

Figure 20: 3 Cases

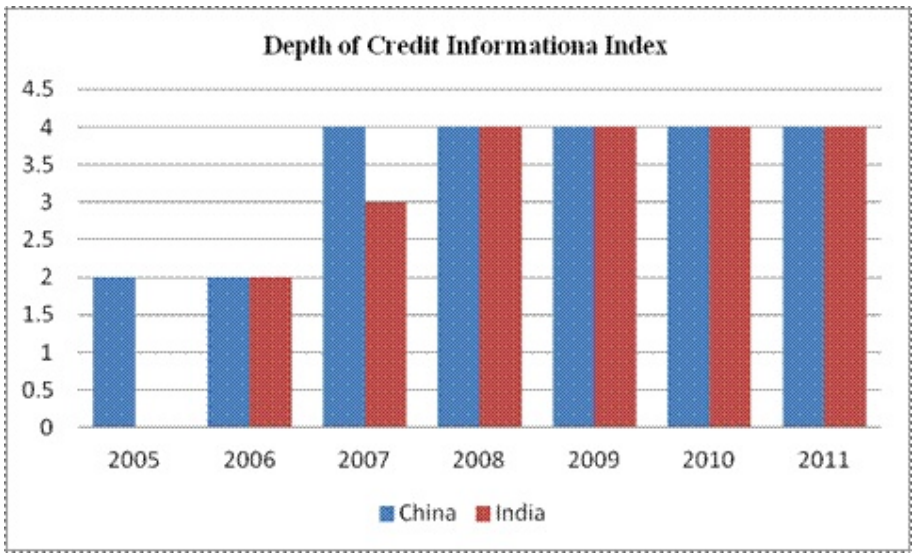

Figure 21: Ease of Doing Business Index

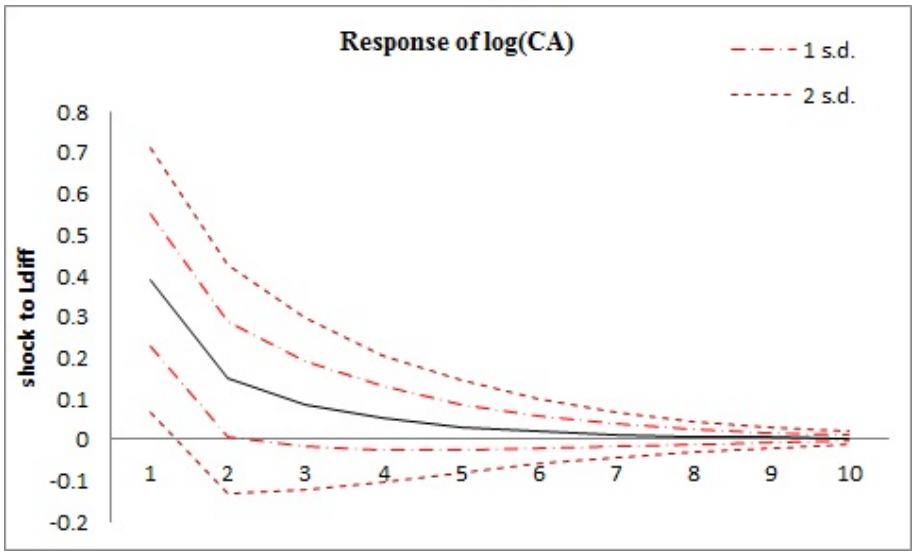

Figure 22: IRF 1 - Response of the Chinese current account balances to one standard deviation of loan issuance shock

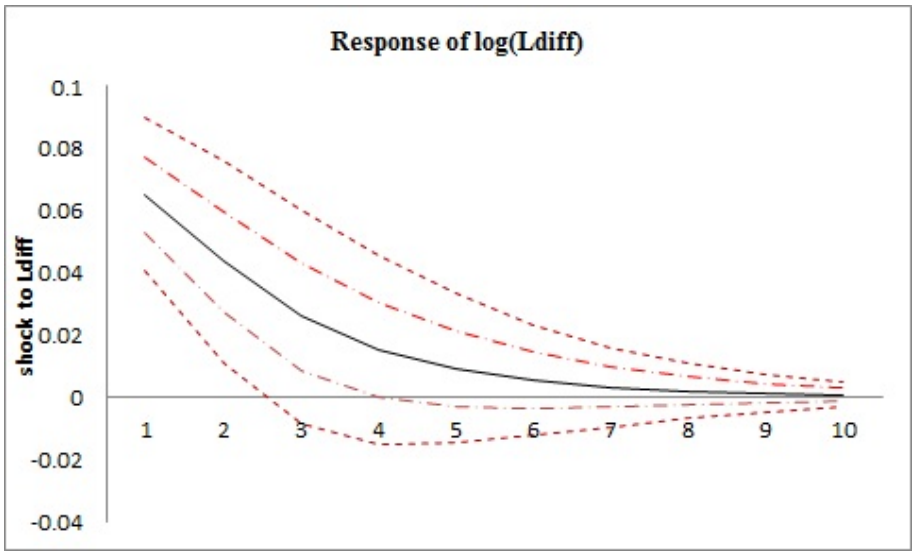

Figure 23: IRF 1 - Response of the differences between SOEs' and POEs' loan issuance to one standard deviation of loan issuance shock

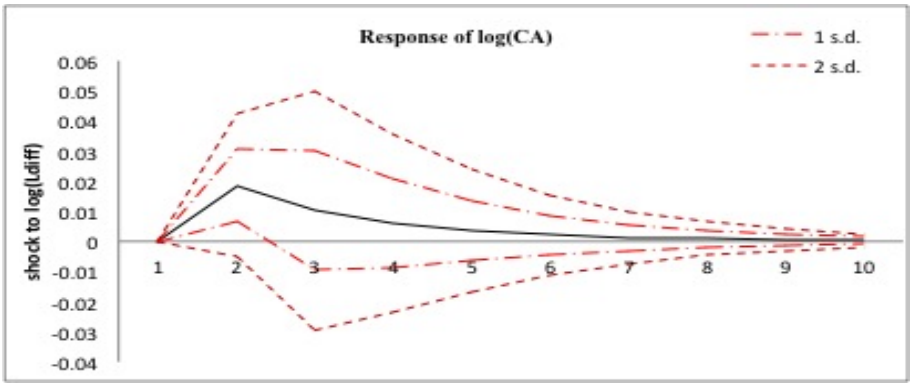

Figure 24: IRF 2 - Response of the US vs China bilateral current account balances to one standard deviation of loan issuance shock

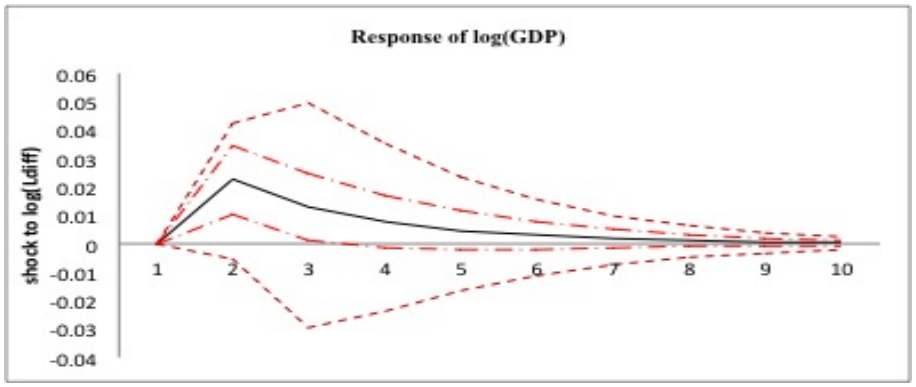

Figure 25: IRF 2 - Response of the Chinese GDP to one standard deviation of loan issuance shock

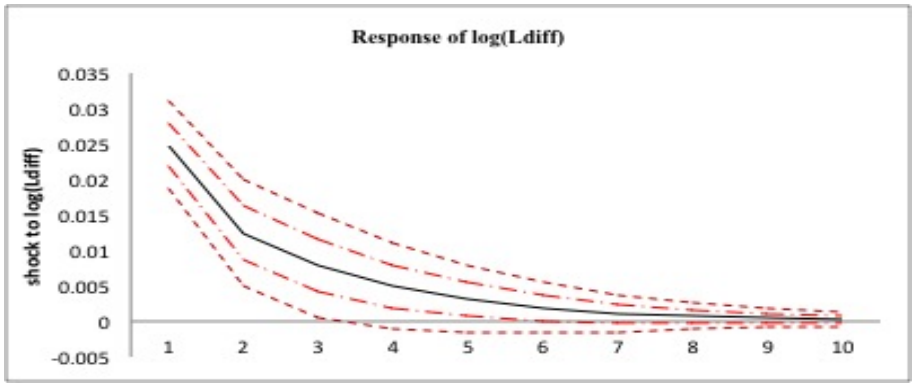

Figure 26: IRF 2 - Response the differences between SOEs' and POEs' loan issuance to one standard deviation of loan issuance shock

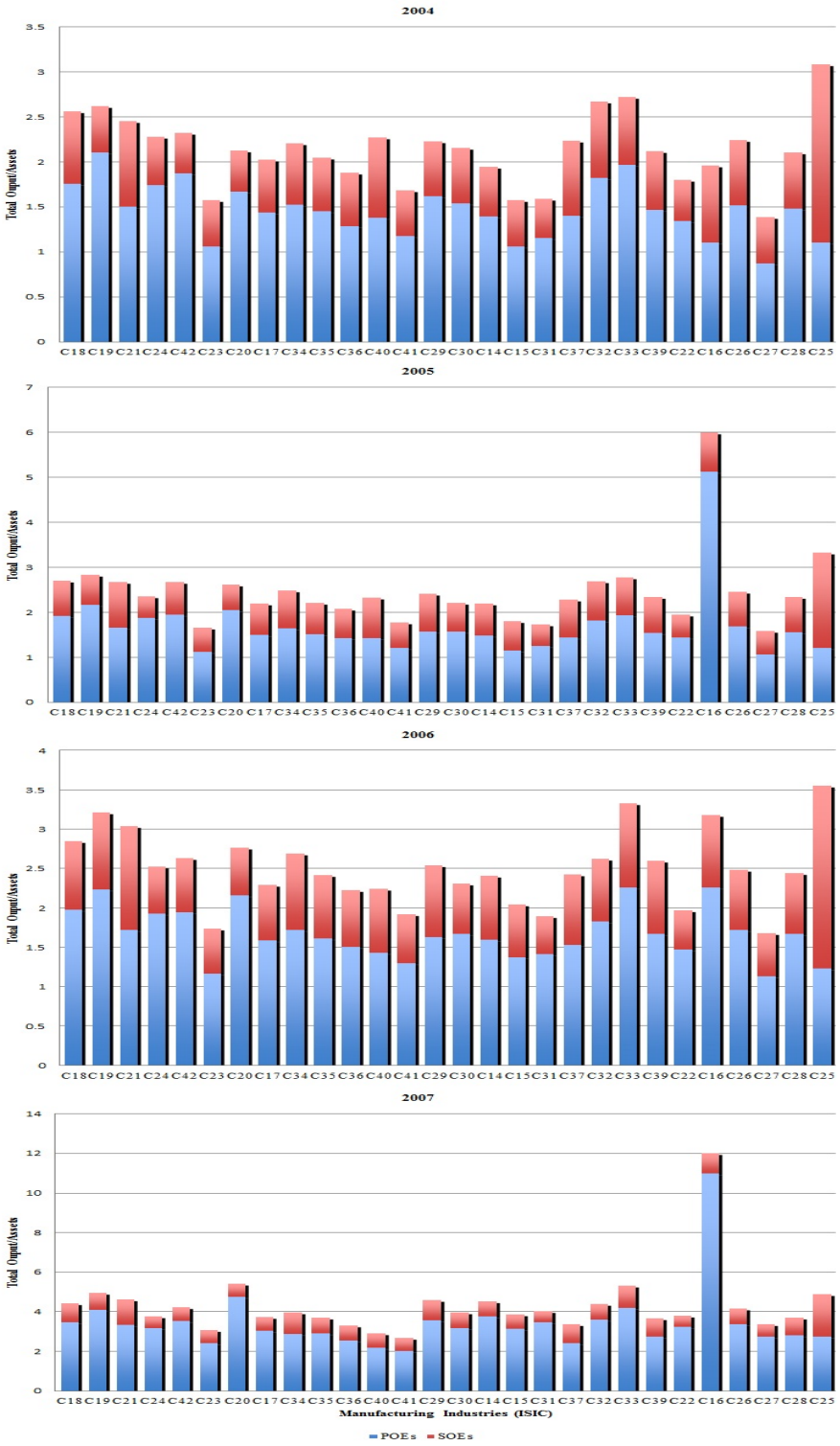

Figure 27: Productivity Comparison between SOEs and POEs Across 28 Manufacturing Industries in China

Table 1: Reserve Requirement Ratio

Date	Reserve Requirement Ratio (in percentage)	Δ in percentage points
1985	10	-
1987	12	2
1988	13	1
21/03/1998	8	-5
21/11/1999	6	-2
21/09/2003	7	1
25/04/2004	7.5	0.5
05/07/2006	8	0.5
15/08/2006	8.5	0.5
15/11/2006	9	0.5
15/01/2007	9.5	0.5
25/02/2007	10	0.5
16/04/2007	10.5	0.5
15/05/2007	11	0.5
05/06/2007	11.5	0.5
15/08/2007	12	0.5
25/09/2007	12.5	0.5
25/10/2007	13	0.5
26/11/2007	13.5	0.5
25/12/2007	14.5	1
25/01/2008	15	0.5
18/03/2008	15.5	0.5
25/04/2008	16	0.5
20/05/2008	17	1
25/09/2008	17.5	0.5
15/10/2008	17	-0.5
05/12/2008	16	-1
25/12/2008	15.5	-0.5
18/01/2010	16	0.5
25/02/2010	16.5	0.5
10/05/2010	17	0.5
16/11/2010	17.5	0.5
29/11/2010	18	0.5
20/12/2010	18.5	0.5

Table 2: OMO 1

Year	Total	Reserve Repos	Repos	Central Bank Bills
2000	132	107	25	0
2001	50	26	24	0
2002	77	45	32	19
2003	73	6	18	49
2004	138	1	43	94
2005	189	3	62	124
2006	137	1	39	98
Total	796	189	243	384

Table 3: OMO 2

Year	Size of Central Bank Bill (RMB 100m)
2000	0
2001	0
2002	1937.5
2003	7226.8
2004	17037.34
2005	27822
2006	36573.81
2007	40721.28
2008	42960
2009	39740