Essays on Financial Frictions: China and Rest of the World

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Declaration

I certify that the thesis I have presented for examination for the Ph.D. degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others. I certify that chapter three and four of this thesis were co-authored with Patrick Imam. I, Jiaqian Chen, contributed over half of the work on these two chapters.

Jiaqian Chen

Abstract

This thesis studies the role of financial frictions in shaping the consumption and investment behavior in China and its implications on rest of the world.

The first chapter uses a panel of Chinese individual level data to show that the inability to borrow against future labour income forces a significant portion of individuals to deviate from a smooth consumption path over the life cycle, which they would otherwise follow. Financial frictions also affect the Chinese corporate sector.

The second chapter 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.

In the third chapter, I move from China to an international perspective. This chapter constructed a measure of financial frictions for 41 emerging economies (EMs) between 1995 and 2008 in order to shed light on common factors across countries. Finally, Chapter four shows econometrically that financial frictions pose a serious danger to EMs, by reducing long run economic growth, raising the probability of a crisis, and leading to asset bubbles. Consistent with Chapter 2, I confirm that financial fractions can also help explain the current account position of EMs.

To my Parents

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Preface

To worry before the whole world worries, and to rejoice after the whole world rejoices.
Fan Zhongyan 1064

China's current account surplus has been on a constantly increasingly trend in recent years, becoming a source of friction with the US, with concern about the system's long-term stability. With China's leadership having characterized macro conditions as "unstable, unbalanced, uncoordinated, and unsustainable" the question is how to rebalance the economy and making the current account surplus sustainable. Policies such as improving the social safety net, reforming public sector and revalue the Renminbi have been advanced by organizations such as the World Bank.

I will, instead, propose an unexplored channel so far, the tackling of financial frictions and development of more efficient capital markets as a way of reducing current account imbalances. In this thesis, I show that financial market underdevelopment - inefficiency in channelling savings to potential borrowers or 'financial frictions' - can be a common factor behind all these policy issues. Motivated by micro evidence, I investigate two different forms of financial frictions. First, I study the impact of *symmetric* liquidity constraints - households' and firms' inability to borrow against their future wealth - for consumption and investment purposes. Second, as my main contribution to the existing literature, I show that distortions caused by *asymmetric* liquidity constraints - whereby different agents within the same economy face different liquidity constraints - 'outweighs' the *symmetric* liquidity constraint in explaining high saving rates, inefficient public sectors and current account imbalances. In particular, aggregate financial market improvement will not mask these distortions caused by asymmetric financial markets. Further-

more, I suggest that policy intervention, such as changes in monetary policy in China, can unintentionally exacerbate these financial frictions. Monetary policy such as Window Guidance - originally designed to control credit quality in the Chinese banking system, however, its implementation distorts credit allocation - creates asymmetric financial markets, as most SOEs are implicitly backed by the local official, rendering SOEs 'safer' regardless their productivity levels.

The first chapter investigates the impact of liquidity constraint on shaping Chinese household's consumption pattern. I begin by testing the null hypothesis that individuals smooth their consumption over the life cycle (permanent income/life cycle hypothesis) against the alternative hypothesis that they optimize subject to a set of well defined borrowing constraints. When the condition is estimated using individual food consumption data drawn from a study of income and consumption dynamics in Tianjin, China and allowing for a general non-separable preference structure, the results support the hypothesis that an inability to borrow against future labour income forces a significant portion of the population to deviate from a smoothed life cycle consumption path, which they would otherwise follow. Moreover, the evidence from rural household suggests that at least a quarter of the Chinese population are unable to make any savings during the years between 2000 and 2007. As a result, policy designed to boost low income households' wage will be a more efficient way to increase consumption level, policy designed to improve financial market structure - such as widening asset classes accepted as collateral and improving credit worthiness assessment system - will be a more efficient way to reduce saving rate, more important these policies should be integrated into current policy tool box in order to correct the current account surplus more efficiently.

However, the first chapter remains silent on the other main ingredient of the current account - investment. The second chapter aim to rationalize high saving rate, (relative) low investment rate - 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. It illustrates how financial frictions within China can induce foreign countries to 'over' consume - current account deficit, via interest rate channel. 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 - after which SOEs' borrowing condition relaxed at cost of tighten credit condition for POEs - 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. This chapter shows that they could jointly be explained in general equilibrium by preferential access to credit for government backed firms.

I then broaden the perspective to an international setting. A quantitative measure of these financial fictions will not only provide a deeper understanding on financial market development over time but also provide an assessment of the financial market development across different countries, which has drawn little attention in the existing literature.

The third and fourth chapter, which is joint work with Patrick Imam, attempt to fill this gap. Chapter 3 begins by illustrating that emerging markets face a shortage of financial assets, with financial assets not growing as rapidly as domestic savings. We then estimate the asset shortage as a measure of the financial frictions in emerging markets between 1995 and 2008. We econometrically estimate the causes of asset shortages. A model is then developed in Chapter 4 that assesses the impact of asset shortages on economic growth, asset bubbles, and the current account. The model is then calibrated and also empirically estimated on a group of 41 emerging markets between 1995 and 2008. The econometric estimations confirm that asset shortages pose a serious danger to emerging markets in terms of reducing economic growth, raising the probability of a crisis, and leading to asset price bubbles. Consistent with the findings in Chapter 2, asset shortages can also explain the current account positions of these emerging markets. The findings suggest that the consequences of asset shortages for macroeconomic stability are significant, and must be tackled urgently. We conclude with policy implications.

In summary, this thesis studies the consequences or distortions (to be more precise) of financial frictions on both domestic economy and its spillover to rest of the world. In particular, the main results suggest that these frictions in the financial market can explain many of the empirical puzzles, ranging from the inefficiency in the state manufacturing sector in China as well as the global imbalances. The macroeconomic implications are grave, and must be addressed to avoid macroeconomic instabilities going forward. I would like to conclude by pointing out that, this thesis barely covered a tip of the iceberg, therefore much more future research is needed in understanding these financial frictions, more important, in designing policy both to spur financial market development as well as correcting these distortions.

Chapter 1

Consumption, Habit Formation and Liquidity Constrains: Evidence from Chinese Consumers

1.1 Introduction

After impressing the world with a 10 percent annual growth rate for the past 15 years, China surpassed Japan in 2010 became the world's second largest economy. However its economic growth miracle relied heavily on investment and export, whereas the contribution from domestic consumption has not been able to match up with the standard positioned by other advance economies. With the Chinese leadership having noticed the inefficiency of state-directed investment, the problems within its trading partners, more important, the un-sustainability of the current model, the question is how to boost the domestic consumption in order for it to become the backbone of future economic growth. Despite efforts in improving the social safety net and reforming the public sector, domestic consumption remains far from the main driver for the Chinese economic growth. As a result, many policies have been proposed and implemented in solving the puzzle, however no obvious result is observed.

This chapter empirically investigates Chinese household consumption behaviour, moreover, making the connection with China's underdeveloped financial market, in particular how will the existence of liquidity constraint affect

consumption decisions. I approach this question by asking: can permanent income/life cycle hypothesis (PIH/LCH) explain the household consumption behaviour in China, if it failed, whether the existence of liquidity constraint can account for this failure.

The permanent income/life cycle hypothesis (PIH/LCH) was thought initially to be relevant for developed market economies only. Therefore testing the explanatory power of the PIH/LCH for Chinese consumers is not only relevant with regard to understanding consumption behaviour of the Chinese household but also has theoretical implication as to applicability of the PIH/LCH model to a more general environment - developing economies. Moreover, a better understanding of the consumption behaviour also shed some light on the Chinese households' saving motivations - as a first step towards a deeper understanding of China's current account surplus. Several empirical studies using aggregate time-series data have rejected restrictions on the data implied by stochastic version of the PIH/LCH, including the work by Hansen and Singleton (1983), Mankiw, Rotemberg, and Summers (1985) and Flavin (1989). Furthermore, some of these authors suggest that the main reason for this rejection is because some individuals are liquidity constrained. However, the work of Altonji and Siow (1987) and Mariger and Shaw (1988) show that this relationship is not presented in all years. More recently, Modigliani and Cao (2004) concluded that the PIH/LCH model matches Chinese household consumption behaviour between 1978 and 2000, despite notable changes in the underlying economy.

Zeldes (1989) identifies household's inability to borrow against future income - liquidity constraint - affects consumption pattern for a significant portion of the US population. In this chapter, I test the validity of this hypothesis in China, in order to gain a deeper understanding of Chinese household consumption behaviour, as well as the role of liquidity constraint. Test statistics are derived to test for consumption behaviour with existence of liquidity constraints and non-separable preferences. The tests are crucially dependent on observing individuals over time. Therefore, I used a panel of 'hand-collected' data from the city of Tianjin, which traces same set of individuals over the years between 1996 and 2005. The goal is to test the explanatory power of the PIH/LCH in a developing country, moreover, whether liquidity constraint is capable to explain the rejections of the PIH/LCH as discovered in the literature. As a result, to shed some light on future policy design in tackling

the low Chinese consumption level.

Since it is difficult to identify the liquidity constrained individuals ex-post, I follow the idea developed in Zeldes (1989). My sample is split into two groups according to different employment categories. Individuals work in more 'prestiges' jobs are less likely to be liquidity constrained (group one), while people with a less 'prestige' job are more likely to be liquidity constrained (group two). Three tests will be carried out in this chapter. The first one involves estimating the Euler equation using data from both groups, with the expectation that the Euler equation should be satisfied for group one and violated for group two, a violation which can take form of implausible parameter estimations. The comparison of the two results will be the key identification strategy for liquidity constraint effect on consumption. Whereas, the general individual's consumption behaviour emerges from regression results using group one data. Secondly, there should be a one-sided inequality in the Euler equation for group two observations. The Lagrange multiplier associated with the liquidity constraint should be strictly positive, the constraint will limit their abilities to transfer additional resources from future to today. Hence the marginal utility of consumption will be much higher today relative to tomorrow than would be predicted in a model with no constraints, in other words, liquidity constrained household's consumption level is much lower than it would have been otherwise. The Lagrange multiplier will be estimated as the 'excess' consumption that is unexplained by the Euler equation. Therefore, if the liquidity constraint exists then the estimator should be strictly positive. Lastly, I estimate the total derivative of the Lagrange multiplier with respect to current period real disposable income. As an increase in current period income would relax the liquidity constraint, value of the Lagrange multiplier should be lower. Hence there is expected to be a negative relationship between the two. The third test is suggestive, but is not a formal test, because the sign of the total derivative is not necessarily equal to the partial derivative.

This chapter tests for liquidity constraint by allowing for very general preference structures. I focus on a specific class of time non-separable preference: those exhibiting habit formations. Habit formation causes consumers to adjust slowly to shocks to permanent income, therefore it can explain the "excess" smoothness of aggregate consumption as suggested by Campbell and Deaton (1989). Also preferences may seem non-separable because of the liquidity constraints: Quantities of other goods or labour market status can

often be constructed as a proxy for anticipated income growth (see Heckman (1974), Deaton (1992), Blundell, Browning, and Meghir (1994), Attanasio and Weber (1993) and Attanasio and Weber (1995)).

The first test shows that individuals in group one (unconstrained group) satisfy the Euler equation, while the Euler equation is rejected for the constrained group. This suggests that individuals in China also follow a well defined life cycle consumption path, moreover liquidity constraint is a key factor forces them to deviate from the PIH/LCH implied consumption path, in particular inabilities to borrow force them to consume less than they otherwise would have done. Furthermore, the second test shows that Lagrange multiplier associated with the constrained group is positive, implies that there is a strictly one-sided inequality in the Euler equation for the constrained group. The point estimate indicates that liquidity constraint caused annual food consumption growth for the constrained group to be 0.95 percentage points higher than it would have been in the absence of constraints (with the rate of return held constant). The last test shows that the total derivative between lagged income growth and consumption growth is negative and it is significant at the 5 percent level.

Overall, this chapter extended application of the PIH/LCH to a developing country, and shown that it is still robust in this case. Furthermore, the estimated Lagrange multiplier for the constrained group is statistically significant and overwhelming, reflects household's inability to borrowing against future resources or existence of the liquidity constraint account for the rejection of the PIH/LCH. These results provide an alternative solution to the Chinese consumption puzzle. It suggests that policies target at Chinese financial market development, which improves liquidity constrained households' abilities to transfer future resources to smooth their current period consumption, will eventually lead to a higher aggregate consumption level and lower saving rate.

More evidence from Chinese rural household are reported in section VI and the results support the findings above. More important, these results suggest that 40 percent of the rural household - that is 25 percent of the total Chinese population - between 1995 and 2007 are not able to save, which is striking given the high aggregate household saving level.

The chapter is organized as follows: Section II discusses the data and the

variables used for the estimation. In section III the models are presented with and without the liquidity constraint as well as the derived Euler equations with non-separable preferences. Section IV discusses the implication of the three tests. The estimation method and empirical results are discussed in section V, with a discussion in section VI and conclude in section VII.

1.2 Data

The core analysis presented in this chapter is based on a dataset collected from individuals residence in urban area of Tianjin, for two main reasons. Firstly, it is very difficult to construct a comprehensive set of panel data to track the same individuals over a period of time, therefore I begin the study by focusing on one city[1]. Secondly, Tianjin is a city consists a population of 10.42 million people in 2005, an area of $11,920$ square kilometers and is one of the four multi-provincial level cities[2] in China. Therefore, I argue the dataset provides a good starting point to understand the broader Chinese economy.

1.2.1 A Brief Description

This dataset was collected in part of a project with the Tianjin Municipal Bureau of Statistics, the goal is to collect a set of panel data in order to study income and consumption dynamics of households who live in Tianjin. Tianjin Municipal Bureau of Statistics has conducted the survey covers both urban and rural area of Tianjin since $1950s$. The survey has been carried out in spring each year and followed same set of individuals over time. It should be noted that the sample used in this chapter are collected on individual basis rather than household, similar to the structure of Panel Study of Income Dynamics (PSID thereafter) dataset, so these data are probably far less influenced by family composition factors that affect household level data. The dataset used for this chapter runs between 1996 and 2005. Post 1990 data is chosen because Chinese national pension system started to take shape in early $1990s$, as a result, household's saving and consumption behaviour is very likely to be changed after this period. Most of the questions in the survey ask for values of the prior calendar year's variables. Throughout the chapter, the value of a variable in year t refers to the value as reported in the survey taken at year $t+1$.

[1] I will also show some results based on rural household data in section VI.

[2] The four multi-provincial level cities are: Beijing, Shanghai, Tianjin and Chongqing.

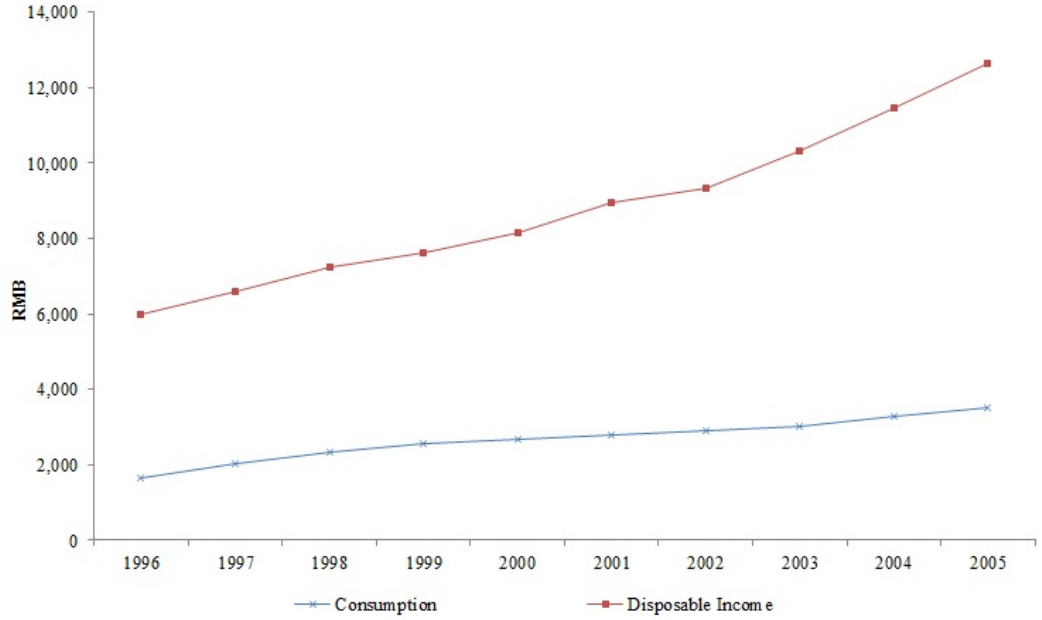


Figure 1.1: Income and Consumption Dynamics

A summary of the two key variables, aggregate disposable income and food consumption over time according to different job categories can be found in Table 1.11 and 1.12. The averaged real disposable income and food consumption are plotted over time (see Figure 1.1). It shows a clear upward trend in both averaged consumption and disposable income over this period, but the averaged real disposable income is increasing with a faster rate. These evidences from the aggregated variables seem to suggest individuals are *unwilling* to increase their consumption despite the increase in their disposable income. However, micro-level data reveals a very different story, in particular, it suggests rather than unwilling, individual *unable* - due to liquidity constraint - to increase their consumption level.

The following briefly describes the variables that are employed for the analysis in this chapter.

Consumption - Food consumption data is used in this chapter, following Hall and Mishkin (1982), Zeldes (1989) and Dynan (2000) among others. Total consumption was not employed because the data quality is very poor. Moreover food consumption represents a significant share of individual's total consumption[3].

[3]Studies suggest that in China, food expenditure make up nearly 40 percent of the total expenditure.

The question in the survey asks "How much do you spend on your food at home and restaurants in an average week?". Food consumption data is very likely to be measured with error, as shown in Table 1.8, it has a very large standard deviation. Fortunately, parameter estimates presented in the following sections are consistent as long as the first difference of the log measurement error of consumption is unrelated to the regressors used.

Real Disposable Income - Questions were asked about how much income do you receive in a month on average during the interview. The nominal disposable income is first calculated as total income minus taxes plus transfers. This is then adjusted for inflation, that is, deflated to constant prices using index numbers. The formula is real disposable income equals disposable income times the base year index, divided by the current year index. This is summarized in Table 1.9, where it shows the average income is $8,833$RMB, with a standard deviation of $4,534$ reflects the poor quality of the data, somehow expected.

Real after-Tax Interest Rate - This reflects the actual rate of interest paid on capital sum after allowance for the effects of inflation, see Table 1.10. In this chapter, it is assumed that only investment option for each individual is to invest in a one year government bond[4]. As a result, each individual's return on capital will be the same and equal to the one-year bond rate, as given by the People's Bank of China.

Year Dummy - In order to capture the year and other un-controlled effects, eight year dummy variables are introduced.

1.2.2 Splitting the Sample

The approach of splitting the sample of individuals into two groups - separating individuals who are more likely to be liquidity constrained and those are less likely to be constrained - is the key for estimation strategy in this chapter. It allows the test of the PIH/LCH, moreover it creates a natural experiment to identify the impact of liquidity constraint. In particular, for group one where each household's current period liquidity constraint is not binding implies the Lagrange multiplier corresponding to the constraint is zero i.e. $\lambda_{i,t} = 0$, whereas for constrained group a positive Lagrange multiplier is

[4]Although it is not a realistic assumption, since household faces a shortage of investable assets in most emerging economies this assumption is not far from the reality.

expected. The sample is split by observations, so that a given individual can sometimes fall in group one and other times in group two.

The sample is split into two groups according to different job categories, because it is expected that nature of an individual's job will have a major impact on the likelihood to be liquidity constrained (see also Carroll and Lawrence (1989)). The idea is that individuals who fall into the low 'paid' group will have less current-period disposable income, less assets and lower savings to use as a buffer stock, however a steeper earning curve. Hence they will have higher willingness, but more constrained (unable) to borrow. Out of the 1500 people sampled, there are 50 professors, 100 government employees, 120 engineers, 130 school teachers, 300 people work in service sector and finally 800 blue collar workers.

50 professors, 100 government employees, 120 engineers, 130 school teachers and 300 people work in service sector (sales) are assigned to the first group, who are less likely (relative to the second group) to be liquidity constrained. The remaining 800 blue collar workers form the more liquidity constrained group two. After this split there are 700 cross sectional observations in group one and 800 in group two, which provides a well balanced sample size in each group.

1.3 The Model

The Euler equation approach to test the PIH/LCH model under rational expectations was first developed by Hall (1978) and extended by Mankiw (1981), Hansen and Singleton (1983) and others. Here the habit formation model is presented with no liquidity constraints and with the corresponding set of Euler equations. In the second subsection, the model presented includes liquidity constraints and derives the corresponding set of Euler equations. Zeldes (1989) first applied this method using PSID data, so this chapter adopts the estimation idea developed by Zeldes (1989) but the Euler equation used in this chapter follows Hayashi (1985) and Dynan (2000). The goal of this section is to extend the applicability of a PIH/LCH model to a developing country, moreover, to understand the role of liquidity constraint in shaping Chinese households' consumption decisions.

1.3.1 The Model Without Liquidity Constraint

It is assumed that individual maximizes expected value of a time non-separable lifetime utility function. In each period t, individual i chooses consumption $C_{i,t}$ by solving the following optimization problem:

$$E_t\Big(\sum_{k=0}^{T-t}\beta^k U(\hat{C}_{i,t+k})\Big) \tag{1.1}$$

subject to:

$$\begin{aligned} A_{i,t+k} &= A_{i,t+k-1}(1+r_{t+k}) + y_{i,t+k} - C_{i,t+k} \\ k &= 0,...,T-t \\ C_{i,t+k} &\geq 0 \\ A_{i,T} &\geq 0 \end{aligned} \tag{1.2}$$

where: $U(\bullet)$ = the one period utility function, $\hat{C}_{i,t}$ = is consumption service in period t, E_t is the expectation operator conditional on information available at time t, β stands for the time discounting factor, which is assumed to be constant for each individual over time. T denotes the end of individual's horizon. $A_{i,t}$ is the real end-of-period financial (nonhuman) wealth of individual i in period t (after receiving income and consumption), r_t is the ex-post real after tax return on asset between period t and $t+1$, finally, $y_{i,t}$ is the real disposable labour income of individual i in period t. Consumption service in period t is positively correlated with current period consumption and negatively related to lagged expenditure.

$$\hat{C}_{i,t} = C_{i,t} - \alpha C_{i,t-1} \tag{1.3}$$

In the case where liquidity constraints do not exist, it is assumed that individuals have access to a financial market in which they can borrow and lend at a riskless rate of interest. As discussed in Zeldes (1989), analytic solutions to this problem when income is stochastic cannot in general be derived. As a result, in this chapter a set of first-order conditions or Euler equations are derived, which are necessary for an optimum. The procedure suggested by Dynan (2000) will be followed for deriving the first order conditions with habit formation. In particular, individuals should be unable to increase their expected life-time utility by consuming one fewer unit today, increasing their asset holding between today and tomorrow then consuming the extra unit the next day. Similarly, if individuals are not constrained from reducing their as-

set at the current amount, then they should not be able to increase expected utility by consuming an extra unit today, decreasing holding, and reducing consumption next period. The first order condition for each individual optimization problem is:

$$E_t\Big(MU_{i,t} - \alpha\beta MU_{i,t+1}\Big) = E_t\Big((1+r_{t+1})\beta MU_{i,t+1} - (1+r_{t+1})\alpha\beta^2 MU_{i,t+2}\Big) \tag{1.4}$$

where: $MU_{i,t} = \frac{\delta U(\hat{C}_{i,t})}{\delta C_{i,t}}$ represents the partial derivative of current utility with respect to current consumption.

The left hand side of Equation 1.4 is the net marginal cost of forgoing one unit of consumption expenditure in period t. The utility in period t decreases and utility in the following period increases because habit stock in $t+1$ is lower. The right hand side represents next marginal benefits of increasing consumption expenditure by $(1+r_{t+1})$ units in period $t+1$. Where habit stock is higher, the utility in period $t+1$ increases and utility in period $t+2$ decreases.

Equation 1.4 is simplified for the purposes of empirical estimation. One reason for this is that there are only a limited number of observations available for empirical estimations. More important, the methodologies suggested by Zeldes (1989) are designed for linear equations, so the model needs to be linearized. Hayashi (1985) provides a simplification of the first order condition when preferences are time non-separable. If the time dimension T is large and interest rate is constant, Equation 1.4 can be reduced to:

$$E_t\Big((1+r)\beta\frac{MU_{i,t+1}}{MU_{i,t}}\Big) = 1 \tag{1.5}$$

Under the assumption of rational expectations, Equation 1.5 implies:

$$(1+r)\beta\Big(\frac{MU_{i,t+1}}{MU_{i,t}}\Big) = 1 + e_{i,t} \tag{1.6}$$

where $e_{i,t}$ is individual $i's$ error uncorrelated with the information available at time t, which reflects innovations to permanent income.

1.3.2 The Model With Liquidity Constraint

Under a general equilibrium setting, Scheinkman and Weiss (1986) show that imposing exogenous restriction that individuals unable to borrow against the future proceeds of their labour can induce price and output fluctuations that

mimic actual business cycles, but that are absent under a perfect markets assumption. The importance of liquidity constraint is tested in this chapter in the context of PIH/LCH, in order to shed some light on the overall Chinese consumption level.

Many different forms of liquidity constraint have been examined in the literature, to be consistent with the theme of this thesis, the constraint used in this chapter is a floor on the total end-of-period net stock of traded asset and it is not endogenously determined[5]. This kind of constraint has also been used extensively in the literature, for example Bewley (1977), Scheinkman and Weiss (1986) and Ljungqvist and Sargent (2004) among others. The equation below constitutes what I refer to as a borrowing constraint throughout this chapter:

$$A_{i,t+k} \geq 0 \tag{1.7}$$

Although liquidity constraint is a bigger set contains the borrowing constraint defined here, I use the terms interchangeably in this chapter[6]. This constraint implies that individual will have non-negative real end-of-period financial wealth in period t, in other words, individuals can not consume today the proceeds from supplying labour in the future.

The two hypothesis essentially differ by the fact that, under the null agents can borrow and lend at the same rate, whereas the alternative hypothesis 'restricts' (liquidity constrained) individual to borrow from the market. Although under the alternative hypothesis that all individuals face a set of constraints at any point in time. Each individual could potentially build up enough wealth in their early periods to relax these constraints, given China is a developing country with low per capita incomes there will be periods where some individuals hit the liquidity constraint. Therefore when the maximization for this problem with the liquidity is derived, there will be a Lagrange multiplier assigned to the constraint. Since the liquidity constraint is just restricting individuals to borrow against their future wealth, while not being

[5]Essentially, the liquidity constraint can arise from financial market underdevelopment or policy distortions. However, the constraint can also be interpreted as it is too expensive for household to borrow.

[6]The constraint can be written in a more general form, for example $A_{i,t+k} \geq -B; k = 0, ..., T - t - 1$ where B is the limit on net indebtedness. In Chapter 2, I consider a slightly more general version of the constraint. Moreover, rather than considering exogenous quantity constrains, it would be interesting to study other reasons, such as credit history and lenders' credit supply conditions which can also lead to sub-optimal lending. Chen and Vera (2012) look into this question using a UK dataset.

restricted for saving. As a result, the Lagrange multiplier is expected to have a positive sign, because if individuals are constrained with regard to borrow by allowing them to borrow one more unit today, this should lead to a positive increase in their lifetime utility - otherwise they would not choose to do so. The 'constrained' version of the Euler equation is shown below:

$$MU_{i,t} = E_t((1+r)\beta MU_{i,t+1}) + \lambda^{''}_{i,t} \tag{1.8}$$

where $\lambda^{''}_{i,t}$ is the Lagrange multiplier associated with the liquidity constraint[7]. For simplicity, I normalized the Lagrange multiplier, define $\lambda^{'}_{i,t}$:

$$\lambda^{'}_{i,t} \equiv \frac{\lambda^{''}_{i,t}}{E_t((1+r)\beta MU_{i,t+1})} \tag{1.9}$$

The Euler equation can be re-written as:

$$E_t\Big((1+r)\beta\frac{MU_{i,t+1}}{MU_{i,t}}\Big)(1+\lambda^{'}_{i,t}) = 1 \tag{1.10}$$

Again by rational expectations, the equation above translates to:

$$(1+\lambda^{'}_{i,t})(1+r)\beta\frac{MU_{i,t+1}}{MU_{i,t}} = 1 + e^{'}_{i,t} \tag{1.11}$$

where $e^{'}_{i,t}$ is the error term.

1.4 Description of the Euler Equation Test

This chapter tests the null hypothesis that individuals are unconstrained PIH/LCH consumers against the alternative hypothesis that individuals are maximizing lifetime utility subject to a liquidity/borrowing constraint.

All tests in the rest of this chapter are based on the implication that a current binding liquidity constraint will result in a violation of the Euler equation. Hereinafter, it is said that liquidity constraint is binding meaning that individuals are constrained to borrow against their future assets/income and this situation implies that the Lagrange multiplier associated with the liquidity constraint is strictly positive and that furthermore, the Euler equation between today and tomorrow is not satisfied.

[7]Scaled by a constant term.

In order to estimate the Euler equation, some assumptions are made about the preferences together with some additional identification assumptions.

1.4.1 Assumptions and Identification Issues

The utility function exhibits habit formation, in particular current utility depends not only on today's expenditures, but also on habit stock formed by lagged expenditures. I assume the utility function is of the constant relative risk aversion form

$$U(\hat{C}_{i,t}) = \frac{(\hat{C}_{i,t})^{1-\rho}}{1-\rho} \tag{1.12}$$

where ρ stands for the coefficient of risk aversion, assumed to be constant for each individual and $\hat{C}_{i,t}$ stands for consumption services in current period, which is positively related to current consumption and negatively related to lagged expenditure.

$$\hat{C}_{i,t} = C_{i,t} - \alpha C_{i,t-1} \tag{1.13}$$

The parameter α measures the strength of the habit formation, when α is large, the consumer receives less lifetime utility from a given amount of consumption, if $\alpha = 0$ then the utility function is in the same form as Zeldes (1989)[8]. The utility function can be substituted into Equation 1.11 and rearranged into the following form:

$$(1+r)(1+\lambda'_{i,t})\beta\Big(\frac{\hat{C}_{i,t}}{\hat{C}_{i,t-1}}\Big)^{-\rho} = 1 + e'_{i,t} \tag{1.14}$$

Taking natural logarithm of the equation above and using Equation 1.13 to substitute for C leads to:

$$\Delta ln(C_{i,t} - \alpha C_{i,t-1}) = \frac{1}{\rho}(ln(1+r) + ln\beta) + \frac{1}{\rho}ln(1+\lambda'_{i,t}) - \frac{1}{\rho}(1+e'_{i,t}) \tag{1.15}$$

Following Muellbauer (1988), I approximate $\Delta ln(C_{i,t} - \alpha C_{i,t-1})$ by $(\Delta lnC_{i,t} - \alpha\Delta lnC_{i,t-1})$ so Equation 1.15 can be rewritten as:

$$\Delta ln(C_{i,t}) = \gamma_0 + \alpha\Delta ln(C_{i,t-1}) + \varepsilon'_{i,t} + ln(1+\lambda_{i,t}) \tag{1.16}$$

For simplicity, $\lambda'_{i,t}$ is normalized with a sign preserving transformation i.e. $(1+\lambda_{i,t}) \equiv (1+\lambda'_{i,t})^{\frac{1}{\rho}}$. Where γ_0 is a constant term, moreover, it is a function of the real interest rate, the time discounting factor and forecast error

[8] without the taste preference parameters

variance, but this chapter assumes that these terms are constant across households and different time periods and $\varepsilon'_{i,t}$ is the error term with mean zero.

As described above, the empirical tests use data on food consumption rather than total consumption. Moreover, I do not consider the role for labour supply or the purchase of durable goods. Therefore, I assume that the utility function is additively separable in food, leisure, and other consumption goods. Otherwise, additional terms will create extra variables in the Euler equation and these data do not exist in the current survey.

1.4.2 Implication and Test I - Euler Equation Estimation on the Two Groups

This chapter follows Zeldes (1989) and Runkle (1991) for the first test, which suggest that the Euler equation is expected to be satisfied for group one but not for group two. For this type of model it is necessary to test whether the information known at time t is orthogonal to the error term. The standard orthogonal test is carried out here by including lagged log of real disposable income growth ($ln(y_{i,t-1}/y_{i,t-2})$) in Equation 1.16, and test statistical significance of this term in the regression. While in Zeldes (1987) log of real disposable income is used, there is a concern that this term is correlated with the expectation error term, because as mentioned earlier, if the current period aggregate income were unexpectedly high, all individuals will have unexpected higher consumption growth between current and last period, and higher aggregate income means that each individual has higher income at macro level. Furthermore, I have included eight extra dummy variables on the right hand side of Equation 1.16 to capture the year effects of the data. So the equation used for empirical estimation has the following specification:

$$ln(\frac{C_{i,t}}{C_{i,t-1}}) = \gamma_0 + \alpha ln(\frac{C_{i,t-1}}{C_{i,t-2}}) + \gamma_1 ln(\frac{y_{i,t-1}}{y_{i,t-2}}) + \sum_k d^k Y D^k_{i,t} + \varepsilon_{i,t} + ln(1+\lambda_{i,t}) \tag{1.17}$$

Equation 1.17 is estimated separately for each of the two groups. Under the null hypothesis that liquidity constraint does not exist, $\lambda_{i,t}$ will equal to zero for both groups, implies that the parameter estimates should be plausible and similar to each other, in particular, income should be insignificant in explaining consumption in both cases. Under the alternative hypothesis that liquidity constraint exists, empirical estimates based on group two data

implies $\lambda_{i,t}$ will not equal to zero and will be correlated with the lagged log income growth term, because $\lambda_{i,t}$ enters in the error term, we would expect a significant coefficient on the lagged log income growth term (i.e. reject the over identification restriction) or there would exist implausible parameter estimates for this group. However, for group one, this constant is not binding which means $\lambda_{i,t}$ will still equal to zero. Clearly, by this set up, if the Euler equation fails only for group two then it reflects the impact of liquidity constraint in shaping households' consumption behaviours. As a robustness check, alternative estimation is carried out, which is similar with Zeldes (1989) method, instead of including lagged log income as a regressors, log income growth is used, so equation of estimation is the following:

$$ln(\frac{C_{i,t}}{C_{i,t-1}}) = \gamma_0' + \alpha' ln(\frac{C_{i,t-1}}{C_{i,t-2}}) + \gamma_1' ln(\frac{y_{i,t}}{y_{i,t-1}}) + \sum_k d^k Y D_{i,t}^k + \varepsilon_{i,t}'' + ln(1+\lambda_{i,t}) \tag{1.18}$$

Moreover, I will use instrumental variable estimation method for each of the groups to take care of potential endogeneity problem, and use lagged log income growth as the instrument for log income growth.

1.4.3 Implication and Test II - One Sided Inequality of the Euler Equation

As mentioned above, under both the null and the alternative hypotheses that $\lambda_{i,t}$ equals to zero for the liquidity unconstrained group. Moreover, since individuals are constrained from borrowing more but not 'borrow less' (save) $\lambda_{i,t}$ must be strictly positive for the constrained group, because if the liquidity constraint is relaxed, individuals in this group should increase their consumption hence marginal utilities of consumption will decrease. Although individuals can not smooth their life time consumption by borrowing, they can save and therefore smooth away an expected drop in future income. In other words, if liquidity constraint exists, the marginal utility of consumption can only be too high today relative to what is expected tomorrow. If second derivative of the utility function with respect to consumption is negative then consumption can be expected to grow faster than if it were liquidity unconstrained although it can never be expected to grow more slowly than if it were unconstrained.

The term $ln(1 + \lambda_{i,t})$ stands for the increase in expected consumption growth due to presence of the liquidity constraint. Under the null hypothesis,

this term is equal to zero for both groups and the parameter estimates should be similar, however, under the alternative hypothesis this term remains zero for group one and if group two observations are not liquidity constrained then this term should be statistically insignificant from zero. To estimate this term, Equation 1.17 will be estimated (without $\lambda_{i,t}$ included) for group one. If the liquidity constraint is not binding for group two, then these parameter estimates will be also consistent estimates for group two. I then use the group one parameter estimates to construct estimates of group two residuals $x_{i,t}$, letting the estimated residual be labeled $\hat{x}_{i,t}$.

The estimated residual $\hat{x}_{i,t}$ in Equation 1.17 includes both the Lagrange multiplier term and the disturbance $\varepsilon_{i,t}$ term. However the $\varepsilon_{i,t}$ term has a mean of zero, hence sample mean of $\hat{x}_{i,t}$ over all observations in group two will equal to the sample mean of the Lagrange multiplier (call this $\bar{\hat{x}}_{i,t}$). Furthermore, as size of cross sectional observation N goes to infinity sample mean of $\hat{x}_{i,t}$ will approach to the population mean. So $\bar{\hat{x}}_{i,t}$ will be a consistent estimate of the group two population mean of $ln(1+\lambda_{i,t})$. In turn, this means that if the liquidity constraint is binding for the second group, this estimate should be statistically significant different from zero, more specifically, strictly positive.

1.4.4 Implication and Test III - The Relationship between $\lambda_{i,t}$ and $y_{i,t}$

For individuals in group two, if their real disposable income increase at time t and all other variables are kept constant, this situation will directly relax their liquidity constraints, consumption should increase today (relative to tomorrow) hence $\lambda_{i,t}$ will fall. Therefore, under the existence of liquidity constraint, there should be a negative partial correlation between $\lambda_{i,t}$ and $y_{i,t}$ (since $y_{i,t}$ is assumed to be uncorrelated with the error term). As a test of this, the estimate $\hat{x}_{i,t}$ is regressed on $y_{i,t}$. The sign will then be tested to see if it is negative. However this is an estimate for the total derivate which may not necessarily be the same as partial derivative.

1.5 Empirical Analysis and Results

As mentioned above, the estimated equation for the first test directly follows from Equation 1.17:

$$ln(\frac{C_{i,t}}{C_{i,t-1}}) = \gamma_0 + \alpha ln(\frac{C_{i,t-1}}{C_{i,t-2}}) + \gamma_1 ln(\frac{y_{i,t-1}}{y_{i,t-2}}) + \sum_k d^k Y D^k_{i,t} + \varepsilon_{i,t} \qquad (1.19)$$

For the first test, I used all the available data that without missing values and the residual is very unlikely to be independent and identically distributed due to nature of the data, as it is very likely that these series contain substantial measurement errors. So before estimating Equation 1.19 for each of the groups, the Wooldridge test for autocorrelation in panel data is checked and result is shown in Table 1.5.

At 5 percent significant level, group two observations can not reject the null hypothesis which implies no first order autocorrelation, but for group one the null hypothesis is rejected at 1 percent significant level, so when carrying out estimations the appropriate adjustment is adapted to take care of AR(1) process.

The estimation results are presented below, based on job classifications for all three tests.

1.5.1 Test I - Estimation for Each of the Two Groups

For group one - liquidity unconstrained group - the Euler equation is not violated. The coefficient estimate for log last period of consumption growth (i.e. $log(C_{i,t}/C_{i,t-1})$) is statistically significant. The constant estimate is significant in the model, which means held all explanatory variables constant there will be a 0.05 percent increase in consumption growth. All the coefficients for year dummy variables are significant except two of them are dropped due to co-linearity. Most important, the coefficient estimate for log income growth in last period is not significantly different from zero at 5 percent level, which is consistent with the initial prediction for the unconstrained group. This result is supported when the regression is estimated base on Equation 1.18 using the instrumental variable approach. Although sign of the coefficient for the log income is changed, but this coefficient estimate remains statistically insignificant different from zero at 5 percent level. Therefore, I can conclude from the empirical results that this is consistent with Euler equation.

For group two, the coefficient estimate for consumption growth in the previous period and the constant estimate are almost identical and both are statistically significant compared to the group one estimates. However, the coefficient for the lagged log income growth is negative, and its magnitude is nearly twice as large as the coefficient estimate for group one, most importantly this coefficient is significantly different from zero at 5 percent level. Again, this evidence is supported when the parameter is estimated using Equation 1.18 and the coefficient for log income growth last period is significantly different from zero at 1 percent level, which is a stronger result. As discussed before, this is inconsistent with the PIH/LCH and this is the prediction under the existence of liquidity constraint. Moreover estimated coefficients for year dummies are all significant apart from the dummy for year 1998, which has been dropped due to co-linearity.

Table 1.1: Test I: Euler Equation for Two Samples

	Dependent Variable: $log(\frac{C_{i,t}}{C_{i,t-1}})$	
Independent Variables	Group 1	Group 2
Constant	0.0482***	0.0477***
	(0.002)	(0.002)
$log(\frac{C_{i,t-1}}{C_{i,t-2}})$	-0.5551***	-0.5374***
	(0.013)	(0.013)
$log(\frac{y_{i,t-1}}{y_{i,t-2}})$	0.0261	-0.0396**
	(0.035)	(0.020)
year dummies	yes	yes
Number of observations	4884	5587
N	698	799

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

To summarize, these results (see Table 1.1 and 1.6) show that the PIH/LCH have significant power in explaining consumption behavior of the Chinese household, moreover, the inability to pledge against future income forces the liquidity constrained household to deviate from a smoothed consumption path.

1.5.2 Test II - One-side Inequality in the Euler Equation

In Table 1.2, I present a consistent estimate for the averaged Lagrange multiplier from group two sample which equals to the averaged unexplained consumption growth in this group. It was expected that this term should be strictly positive for the constrained group two. The Portmanteau test for

white noise is carried out for the sequence of $\hat{x}_{i,t}$. Since the sample size is relatively large, the central limit theorem implies that $\hat{x}_{i,t}$ should be white noise. Table 1.7 shows rejection of the Portmanteau test, which suggests this sequence is not white noise. The point estimate for the averaged Lagrange multiplier is 0.010. Moreover, this averaged Lagrange multiplier is significantly greater than zero at 1 percent level (one tail test) because the sample mean should follow a normal distribution with a mean of 0.01 and a variance of $0.051/n$ (n=sample size).

Table 1.2: Test II: Estimate of Average Excess Consumption Growth

	Group Two due to Binding Liquidity Constraint
$\bar{\hat{x}}_{i,t}$	0.0095229^{***}
	(0.051)

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Furthermore, the histogram plotted in Figure 1.4 confirms these error terms are not only statistically different from zero, but greater than zero on average. In particular, Figure 1.4 shows most of the estimated 'errors' are indeed lying on the positive region. The estimate is more statistically significant compare to the one in Zeldes (1989), which is consistent with the expectation that Chinese households are more liquidity constrained relative to household in US. The possible reasons behind the underdevelopment of Chinese financial markets are being explored in the second and third chapter of this thesis.

So far, the first test leads to a rejection of the Euler equation for liquidity constrained group but not for group one. The second test indicates that sign and magnitude of the one-sided inequality are consistent with the view that liquidity constraints exist and have a major impact on individual's consumption behaviour in particular liquidity constrained households consume less than they would otherwise have done.

1.5.3 Test III - Relationship between Unexplained Consumption Growth and Income

The results from regressing $\hat{x}_{i,t}$ on the log of real disposable income ($\ln(y_{i,t})$) is shown in Table 1.3. The estimated coefficient for the log of real disposable income is negative, more important it is statistically significant at 5 percent level. The coefficient is a consistent estimate of the relationship between the

Lagrange multiplier and current income, it suggests that individuals in group two are facing a binding borrowing constraint. It is negative, meaning that if disposable income at time t increases and nothing else in the model changes, the constraint will be relaxed directly, hence the Lagrange multiplier will fall.

Table 1.3: Test III: Regression of Estimate of Excess Consumption Growth

	Group Two on the log of Real Disposable Income
$\ln(y_{i,t})$	-0.0913**
	(0.008)

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

1.6 Discussion

1.6.1 Evidence on Habit Formation

So far the discussion has focused on impact of liquidity constraint on households' consumption behaviors. Since the utility function exhibits habit formation, whether Chinese household's consumption behaviour has been influenced by habit formation can be studied using the estimation results based on liquidity unconstrained (group one) sample. The habit formation model predicts α in Equation 1.16 to be strictly positive, with its magnitude reflecting the fraction of past expenditures that make up the habit stock and indicating the importance of habit formation in behavior. Intuitively, Equation 1.16 shows that habit formation creates a positive link between current and lagged consumption growth, which stems from consumers' gradual adjustment to permanent income shocks. In contrast to traditional models in which consumption adjusts immediately to permanent income innovations, habits cause consumers to prefer a number of small consumption changes to one large consumption change. Results in Table 1.1 shows that the coefficient estimate for α is -0.56, thus, there is no evidence of significant habit formation in food consumption.

Some caveats apply in making the conclusion, for example durability in the data could partially or even completely obscure habit formation. Durability tends to offset habit formation in behaviour, it makes expenditure growth lumpy whereas habit smooth it out. Hayashi (1985) shows that with durability alone, $\hat{\alpha}$ should be negative. The variable of interest in this chapter is annual food consumption, therefore it is very unlikely to be durable. However, the re-

sults hinge on the assumption that preferences are separable in food and other expenditures, if food were a complement to other expenditures, the durability of related goods might affect the dynamics of food spending. Unfortunately, it is impossible to study separate habit formation and durability parameters with the current dataset and it is not the main focus of current chapter.

1.6.2 An Alternative 'Story' on Aggregate Chinese Consumption

As the results based on group two observations show, if additional resource can be obtained, for example by allowing household to borrow against future income or increase low income bracket households' disposable income, liquidity constrained households will respond by increasing current period consumption, whereas the effect is silent for the unconstrained group. This result provides an alternative story in explaining the low consumption level (as share of GDP) in China - suppose that liquidity constrained households have a 'desired' level of consumption (implied by the PIH/LCH) over their lifetime, moreover they expect their future income will grow at a rate in line with the rate which the aggregate economy grows. Now during early period of their life time, they would have borrowed to smooth their consumption, in particular, they borrow against expected (higher) future income, to increase current period consumption. However, due to the existence of liquidity constraint they can only consume what their current period income allows. Whereas in the later part of life time (before retirement), their incomes easily exceed the cost of 'desire' level of consumption therefore they will save the remaining incomes. This story predicts that the low consumption level, moreover the high saving rates in China will automatically correct itself as the financial market develops and household's income grows (evenly across different income brackets) in China. Moreover, it suggests the policy focus should be steered away from the conventional views, on to financial market development and increase household's income.

Unfortunately this hypothesis is not tested in this chapter due to data limitation, however, in the next subsection I discuss some findings from the rural area in China does also support this argument.

1.6.3 Some Evidence from the Rural Household

Rural household represents a large share of the total population in China, although this share has fallen from over 70 percent during 1990s to 50 percent by 2010, it still represents nearly 7bn people. The ratio between averaged rural household net income to urban household disposable income has fallen from 45 percent in 1990 to 31 percent in 2010. Moreover, the price index for rural residence grown at a similar rate as the urban price index, while the rate of rural household income increased has not been able to match up with the urban counter part. Therefore, it is natural to expect that the rural households are more liquidity constrained relative to the urban households, put it differently, if liquidity constraint or even precautionary saving motives (as argued in the literature as the main factor drives the high saving rate in China) have any effects on the Chinese household consumption and saving decisions, they should have larger impact on the rural household.

To my knowledge, very few analysis using Chinese rural household data exist in the literature, the main reason was due to data availability, unfortunately, I do not escape from this problem. It is very difficult to track same set of individuals over a period of time to construct a similar panel in rural China. Therefore in this subsection I try to provide some evidences based on a country-wide dataset which reveal three key findings: 1, liquidity constraint has a significant impact in shaping household consumption behaviours in rural area; 2, similar to my previous findings, liquidity constraint affects the low income bracket households the most. Moreover, the analysis suggests that the bottom 40 percent of the rural household are *unable* to save, in other words, it is the households in top income brackets, after meeting their 'desired' level of consumption, depositing the 'extra' incomes (due to lack of investment opportunities, the extra income is usually packed at bank deposit.) and contributing to the high aggregate saving rate in China. This is particularly interesting, because if this finding is robust, then policy interventions such as improving the social safety nets will not necessary have a big impact on boosting Chinese consumption level or lowering the saving rate in China[9]. Instead, policy designed to boost low income households' wage will be a more efficient way to increase consumption level, policy designed to improve financial market structure - such as widening asset classes accepted as collateral and improving credit worthiness assessment system - will be a more

[9]This does not imply the Chinese Government should not improve the social safety net, instead it says these policy will have little impact on resolving the 'saving glut'.

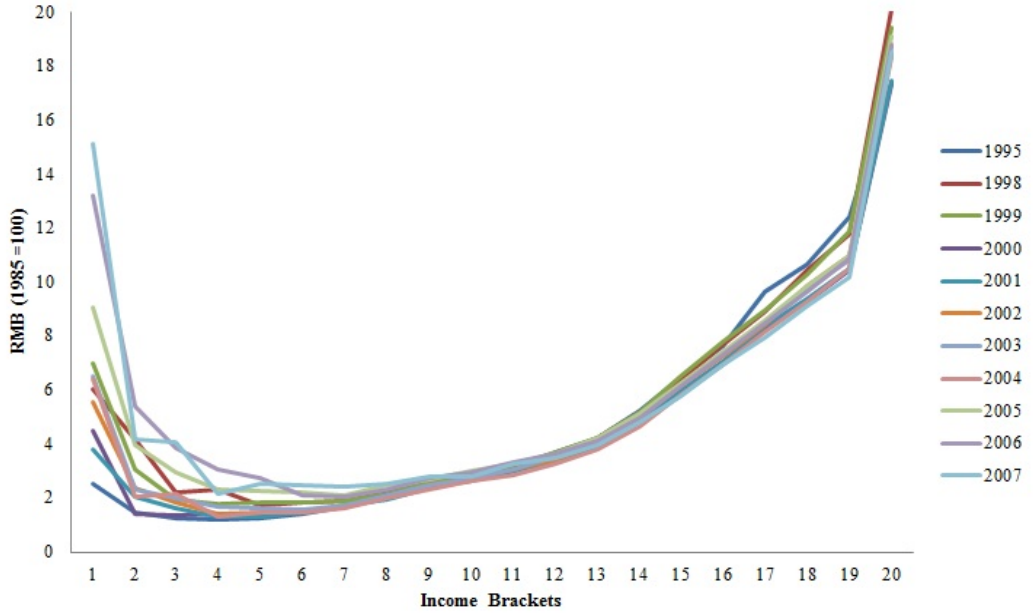


Figure 1.2: Cash Income for Rural Household

efficient way to reduce saving rate, more important these policies should be integrated into current policy tool box in order to correct the current account surplus more efficiently.

The analysis is based on the China Yearbook of Rural Household Survey sampled by the National Statistical Bureau of China for the years of 1980, 1985, 1990, 1995 and between 1998 to 2007. Figure 1.2 and 1.3 illustrate finding 1 and 2, show the cash income and cash consumption across 20 income brackets[10] between 1995 and 2007.

Both figures revealed a 'U' shaped curve, moreover, households fall into the mid-income groups either saw their income nor consumption changed very much across different periods. Whereas, households fall into the top income bracket represented on the right-hand side of the figures, and the low income groups who fall into the other end of the spectrum, demonstrated the biggest differences. If the slope of these curves can be interpreted as how much consumption will increase if additional income was made available in the current period, two figures show that the 'marginal propensity' to consume is much higher for the low income household relative to the high income ones, which support the empirical findings above.

[10]Defined by the National Statistical Bureau of China.

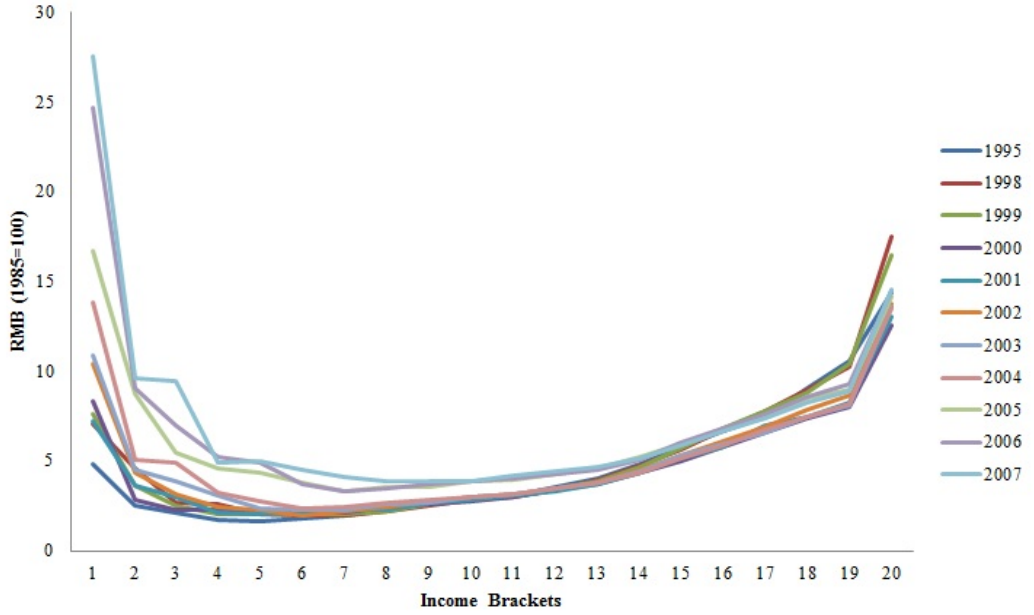


Figure 1.3: Cash Consumption for Rural Household

Moreover, I constructed a simple measure (based on the data available) tries to capture the idea of *inability to save* which reflects both the household's ability to save as well as to consume, defined as:

$$\text{disposable income(cash)} - (\text{total income} - \text{cash income}) - \text{living expenditure(cash)}$$

The idea is that if this measure is below 0 implies in the current period (year), the households on average (within this income bracket) will not have sufficient cash income to finance their cash living expenditures[11], as a result they will not only be credit constrained to achieve the 'desired' (implied by the PIH/LCH) level of consumption, but will not be able to save for example making any bank deposit. The share of rural household who fall into this category is listed in Table 1.4 for the years that data is available and I argue this measure provide, at least, a lower bound of the share of rural household who are unable to save.

These results suggest that on average 40 percent of the rural household can not save, that is a quarter of the total Chinese population, on the other hand household in the top income brackets, alone, is contributing to the high saving rates in China.

[11]this shortfall is normally met using savings or interest payment.

Table 1.4: Share of Rural Household who 'Unable' to Save

Year	Share of Household
1980	34.8
1985	62
1990	69.8
1995	56.6
1998	33.5
1999	31.91
2000	39.57
2001	37.42
2002	35.57
2003	33
2004	34.3
2005	42
2006	36.3
2007	38.1

Note: This table shows the share of rural household who are *unable* to save as defined in the text.

1.7 Conclusion

The literature has argued that existence of liquidity constraint, in particular households' inability to borrow against their future resources, has significant impact on households' consumption decisions as a result, it leads to rejection of the Euler equation. In this chapter, I have examined the application of the PIH/LCH for a developing country - China, moreover the role of liquidity constraint using a set of 'hand collected' micro-level data. The approach is similar to the one used in Zeldes (1989). From the empirical results, it can be concluded that the Euler equation holds for the household in my sample, therefore I expect the PIH/LCH may also applicable to other developing countries. Moreover, one important reason accounts for the failure of the PIH/LCH is the existence of the liquidity/borrowing constraint.

Beside the implications on the PIH/LCH, the results also shed light on the Chinese household consumption behaviour. Essentially, these results suggest that one of the key reason for low consumption level in China is due to liquidity constraint, therefore even if household willing to increase their current period consumption due to an expectation of higher future income or an improved social safety nets in the future, they will not able to transfer these future income in order to increase today's consumption which lead to a low consumption at aggregate level. These results are supported by the rural household.

However, these results should be interpreted with caution. The data contains considerable measurement errors as well as less than ideal in that some more variables need to be constructed. The model could be improved by many ways, such as introducing bequest motive and a taste factor in the utility function or including some demographic information of each individual and some household information. Moreover, tests should be re-estimated using different ways of splitting the sample as a robustness check. I conclude the main improvement is needed on the quality of data collection, which is one of the tasks I am currently undertaking.

1.A Appendix

1.A.1 Tables

Table 1.5: Wooldridge Test for Each Subsample

Group 1	Group 2
Test for autocorrelation in panel data	Test for autocorrelation in panel data
H_0: no first-order autocorrelation	H_0: no first-order autocorrelation
F(1, 697) = 24.341	F(1, 798) = 3.809
Prob > F = 0.0000	Prob > F = 0.0513

Note: This table shows the Wooldridge test statistics for autocorrelation of household consumption.

Table 1.6: Test I: Euler Equation IV Estimation for Two Samples

	Dependent Variable: $log(\frac{C_{i,t}}{C_{i,t-1}})$	
Independent Variables	Group 1	Group 2
Constant	0.0418***	0.0279***
	(0.002)	(0.002)
$log(\frac{C_{i,t-1}}{C_{i,t-2}})$	-0.4550***	-0.5009***
	(0.014)	(0.012)
$log(\frac{y_{i,t}}{y_{i,t-1}})$	-0.017	-0.0394***
	(0.036)	(0.020)
year dummies	yes	yes
Number of observations	5581	6386
N	698	799

Note: This table shows the instrumental estimation for Equation 1.18, where lagged log real disposable income growth is used as an instrument for log real disposable income growth. Robust standard errors in parentheses $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 1.7: Portmanteau Test for White Noise

Portmanteau for white noise	
Portmanteau (Q) Statistic	5219.9816
Prob > chi2(40)	0

Note: This table shows the Portmanteau test statistics for white noise of the error term in Equation 1.17.

1.A.2 Figures

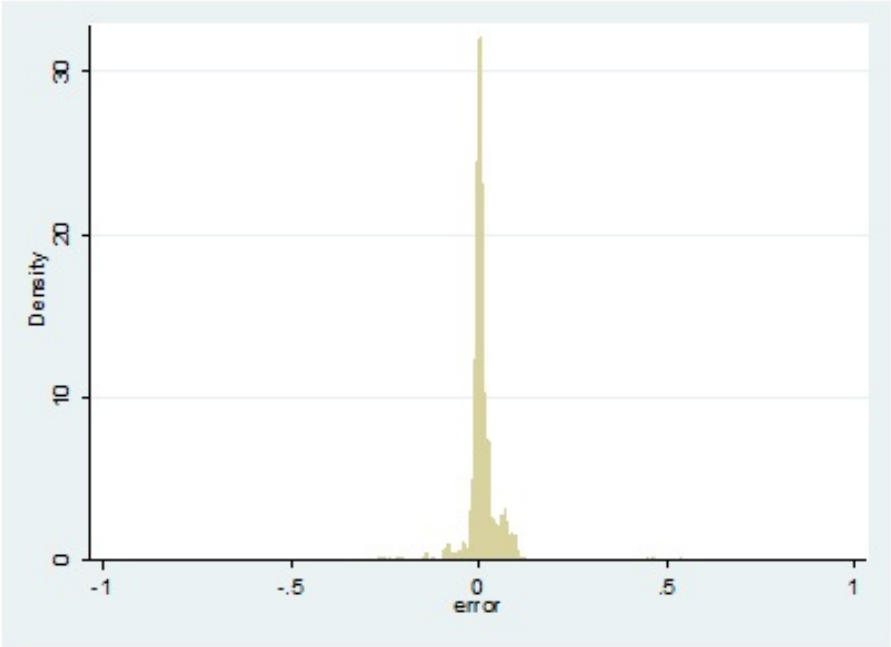


Figure 1.4: Histogram for the 'Error' Term

1.A.3 Data

Table 1.8: Descriptive Food Consumption Statistics

Variable		Mean (RMB)	Std. Dev.	Min (RMB)	Max (RMB)	Observations
Food	overall	2682.02	1369.961	172.1	19965.2	N = 14997
Consumption	between		1199.6	1839.68	8591.53	n = 1500
	within		662.1212	2927.97	17072.87	T-bar = 10

Note: This table shows some summary statistics of food consumption between 1996 and 2005 for household resident in Tianjin.

Table 1.9: Descriptive Real Disposable Income Statistics

Variable		Mean (RMB)	Std. Dev.	Min (RMB)	Max (RMB)	Observations
Real	overall	8833.426	4534.746	522.1	36996.5	N = 14997
Disposable	between		3929.88	6091.38	26108.82	n = 1500
Income	within		2264.347	1354.174	20920.2	T-bar = 10

Note: This table shows some summary statistics of real disposable income between 1996 and 2005 for household resident in Tianjin.

Table 1.10: Real Annual Interest Rate

Year	Real Interest Rate
1996	9.18
1997	7.47
1998	5.67
1999	5.22
2000	4.77
2001	3.78
2002	2.25
2003	1.98
2004	2.25
2005	2.52

Note: This table shows the real interest rate one year government bond.

Table 1.11: Data Description I

Job Classifications	Sample size	Real disposable income 1996	Food consumption 1996	Real disposable income 1997	Food consumption 1997
Govt. Employee	100	1980010	555046	1796495	524559
Engineer	120	2174390	609536	1972859	576056
Professor	50	1796020	503469	1629558	475815
Teacher	130	2207370	618781	2002782	584793
Worker	800	7488010	2099075	6793992	1983780
Sales	300	3312025	928443	3005054	877447
Total	1500	18957825	5314350	17200740	5022450
Average		12638.55	3542.9	11467.16	3348.3
Job Classifications	Sample size	Real disposable income 1998	Food consumption 1998	Real disposable income 1999	Food consumption 1999
Govt. Employee	100	1615666	473346	1462859	456426
Engineer	120	1774277	519815	1606470	501234
Professor	50	1465531	429361	1326925	414013
Teacher	130	1801188	527698	1630836	508836
Worker	800	6110129	1790100	5532248	1726113
Sales	300	2702574	791780	2446972	763478
Total	1500	15469365	4532100	14006310	4370100
Average		10312.91	3021.4	9337.54	2913.4

Note: This table shows some summary statistics of real disposable income and food consumption in RMB between 1996 and 1999 for household resident in Tianjin.

Table 1.12: Data Description II

Job Classifications	Sample size	Real disposable income 2000	Food consumption 2000	Real disposable income 2001	Food consumption 2001
Govt. Employee	100	1403509	435088	1275334	420111
Engineer	120	1541293	477801	1400535	461354
Professor	50	1273089	394658	1156825	381073
Teacher	130	1564670	485048	1421777	468351
Worker	800	5307795	1645419	4823063	1588778
Sales	300	2347694	727786	2133291	702733
Total	1500	13438050	4165800	1210825	4022400
Average		8958.7	2777.2	8140.55	2681.6
Job Classifications	Sample size	Real disposable income 2002	Food consumption 2002	Real disposable income 2003	Food consumption 2003
Govt. Employee	100	1198456	401954	1113968	367425
Engineer	120	1316109	441414	1223328	403495
Professor	50	1087091	364603	1010454	333282
Teacher	130	1336071	448109	1241882	409615
Worker	800	4532324	1520110	4212809	1389529
Sales	300	2004694	672360	1863369	614604
Total	1500	11474745	3848550	10665810	3517950
Average		7649.83	2565.7	7110.54	2345.3
Job Classifications	Sample size	Real disposable income 2004	Food consumption 2004	Real disposable income 2005	Food consumption 2005
Govt. Employee	100	1035326	317919	935241	259060
Engineer	120	1136965	349129	1027054	284492
Professor	50	939119	288377	848335	234987
Teacher	130	1154210	354425	1042632	288808
Worker	800	39155399	1202307	3536897	979715
Sales	300	1731821	531793	1564406	433338
Total	1500	9912840	3043950	8954565	2480400
Average		6608.56	2029.3	5969.71	1653.6

Note: This table shows some summary statistics of real disposable income and food consumption in RMB between 2000 and 2005 for household resident in Tianjin.

Chapter 2

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

2.1 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 2.1).

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 2.2).

Fact 3: The long run real interest rate has been declining over the last decade (see Figure 2.3), despite recent efforts from central banks to raise interest rates - The "Greenspan's Conundrum".

Despite extensive studies on various factors driving this environment, there

[1]India, a country which is at a similar stage of financial development as China (according to the Financial Freedom Index see Figure 2.12), 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 market development.

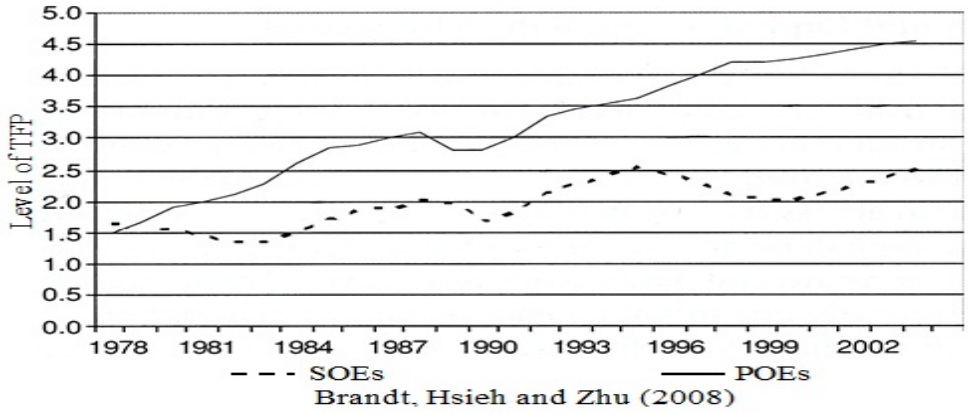


Figure 2.1: TFP Levels - SOEs vs. POEs

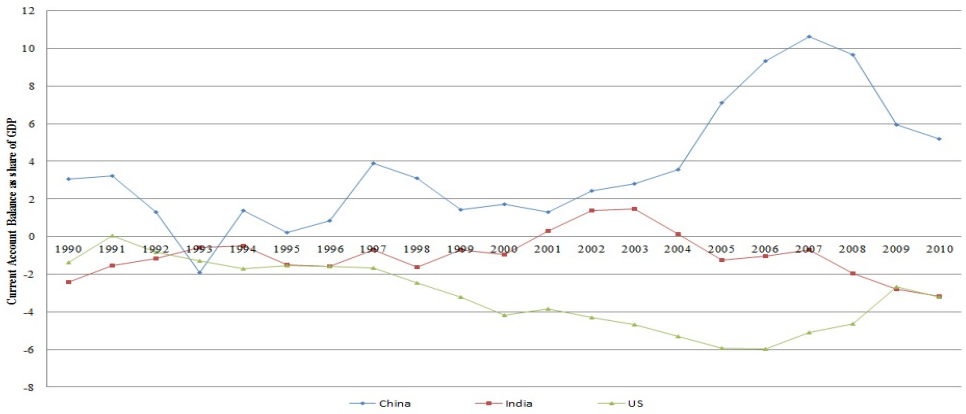


Figure 2.2: Current Account Balances

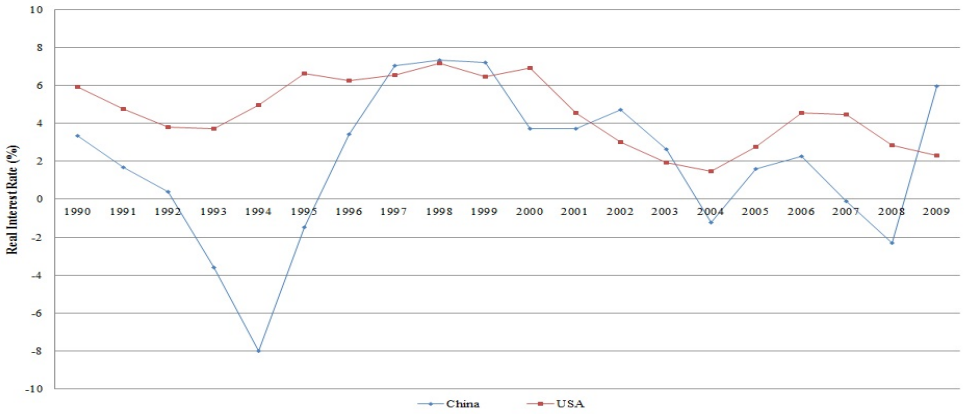


Figure 2.3: Real Interest Rate

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 fact 2 and 3, although these facts are deeply integrated in practice. In this chapter I argue that such separation between the real economy and the financial market is not warranted when the 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 Zilibotti (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 2.13). From the TFP accounting point of view, Brandt, 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 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 markets 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 frictions have proven to be one of the most important factors behind both investment and economic development (see Jeong and Twonsend (2005), Amaral and Quintin (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 chapter, shock to a firm's borrowing ability affects its optimal entry decision. These decisions collectively form the structure of the industry, in turn affect the equilibrium productivity level, furthermore the new industrial composition will interact with the financial shock shapes the new 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. Bacchetta and Benhima (2010) 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 bond complements 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 saving rate than the global average. It is the household's counterpart 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 Zilibotti (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 main mechanism 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, Biesebroeck, and Zhang (2009) show the average entry and exit rate of Chinese firms is around 11 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. Figure 2.14 and 2.15 compare the fixed capital investment and output levels in manufacturing sector 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 chapter, 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 fixed assets such as land, are the most important collateral accepted by commercial banks (especially in EMs like China) when they assess the credit worthiness of the POEs. Given Chinese firms' high entry and exit rates, in this chapter 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 [2] 2.4. Therefore, if any of the current account imbalances are driven by the level of aggregate financial market development, we should expect the current account surplus in China to shrink and the savings in EMs to fall. In this chapter, I argue the level of aggregate financial development is just a

[2]Figure 2.4 illustrates the total loan outstanding between 1990 to 2008.

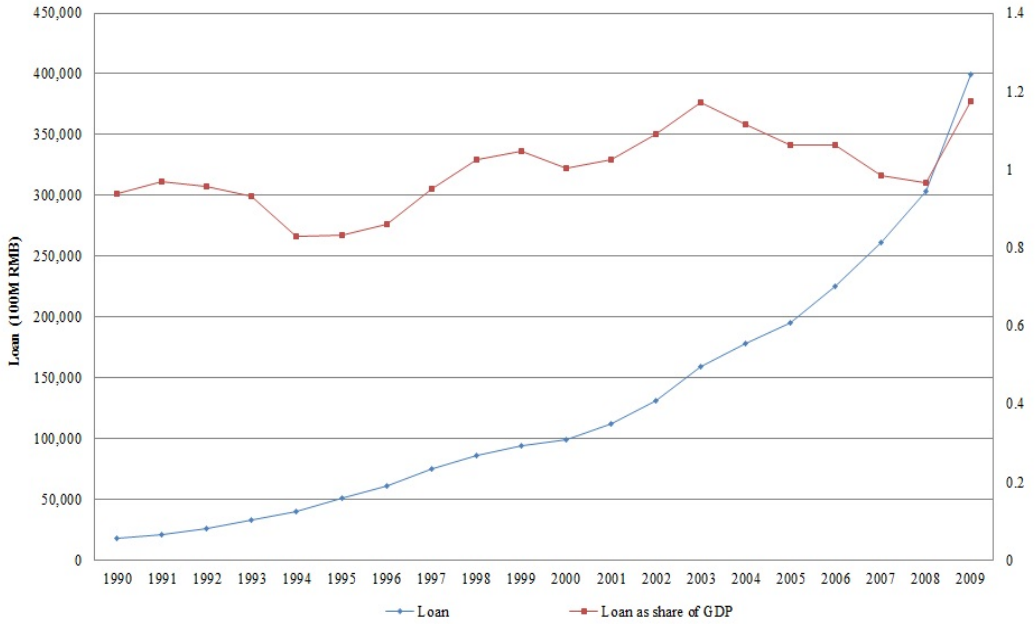


Figure 2.4: Loan Balance by end of Year in China

sideshow when asymmetric financial markets co-exist within the economy.

Dooley, Folkerts-Landau, and Garber (2003) and Dooley and Garber (2005) argue that the current pattern of US external imbalances does not represent a threat to the global macroeconomic environment. Their "Bretton 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 affect 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 chapter is to provide a framework to analyze global equilibrium when two financial markets[4] co-exist in one country, and

[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

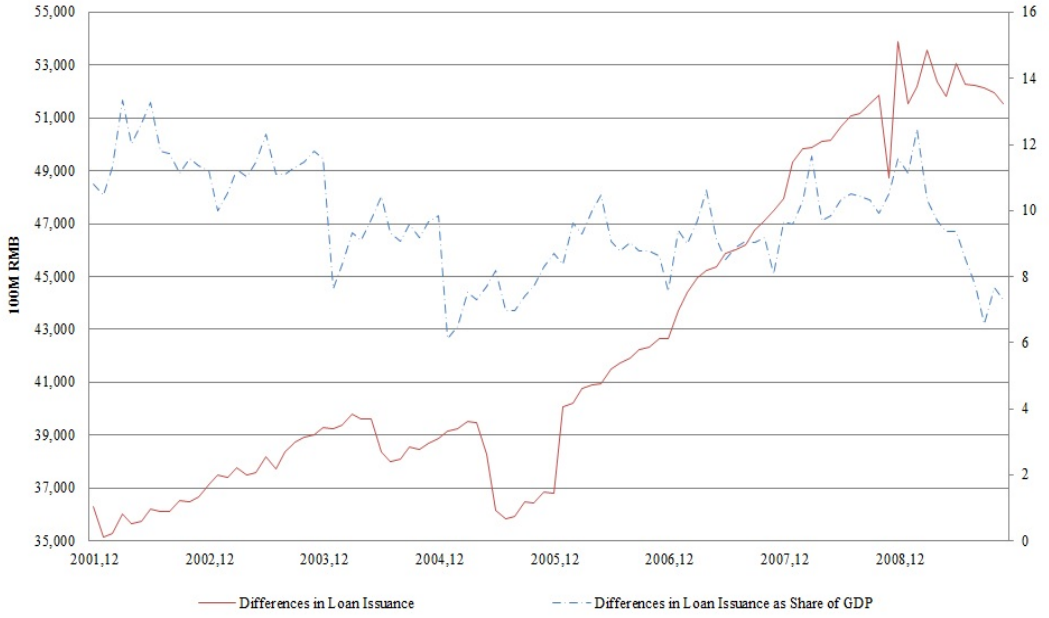


Figure 2.5: Differences Between SOEs' and POEs' Loan Issuance in China

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 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 dramatic divergence in credit allocation between SOEs and POEs appears in Figure 2.5, 2.16 and 2.17, 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

ability.

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 answer to the first question is "No" and in this chapter I show many facts in the Chinese economy can be explained by the co-existence of asymmetric borrowing constraints, 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 see Figure 2.18). 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

[5]To be consistent with empirical evidences, throughout this chapter 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 chapter, I use words: credit constraint, borrowing constraint and borrowing ability interchangeably, but they all refer to the same concept as defined here.

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

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

2.2 Some Stylized Facts in the Chinese Economy

2.2.1 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 (PBC) 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 sector); the Agriculture Bank of China (ABC) was set up in 1979 to deal with all banking business in rural areas and the PBC was formally established as China's central bank; finally, the fourth 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 PBC[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 (2003)). 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 (2003) 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

[10]Note, the four state-controlled commercial banks possess 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.

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 Zilibotti (2011)). Similarly, Dollar and Wei (2007) and James, 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 private 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] (Neil and Tenev (2001) and James, 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 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 (2003) using firm level data, shows the share of POEs, ranked for-

[11] In this chapter, 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.

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

mal 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 chapter I look at some direct measurements, namely how much of loan, syndicated loan and bond have issued by 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 2.5. Moreover, syndicated loan issuance data in Figure 2.16 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 market 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 2.17 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 drive the allocation of the credit on an ad-hoc basis were frequently implemented .....

[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 chapter, although some papers have proposed a few possible explanations see Huang (2003) and Shih (2004).

2.2.2 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, which I argue as unexpected 'side-effects', these policy interventions lead to a distortion in credit allocation 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 increase 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 the 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

[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.

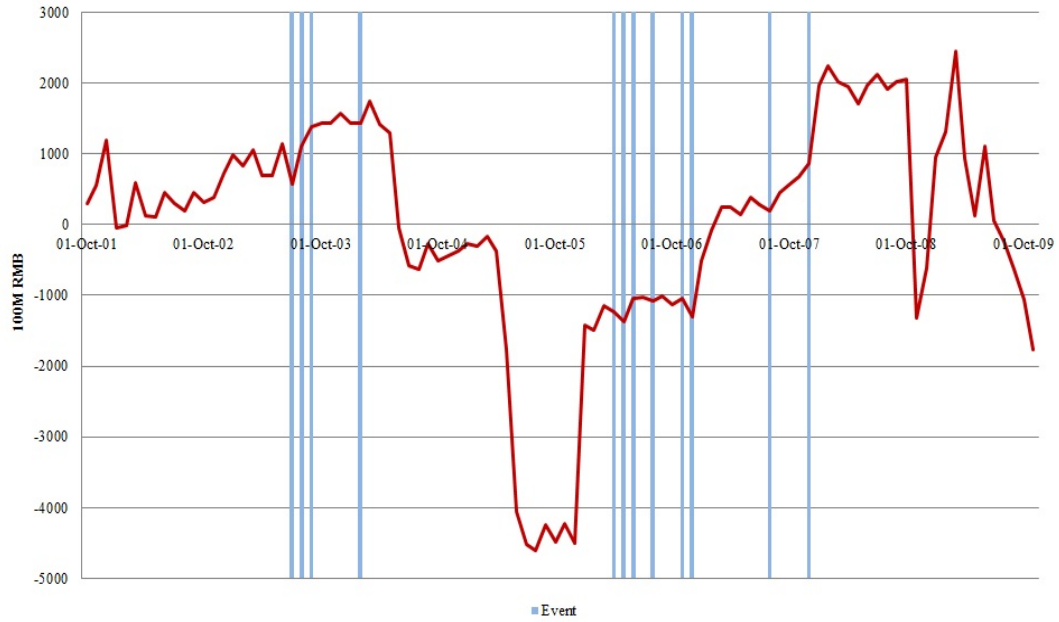


Figure 2.6: De-trended Differences Between SOEs' and POEs' Loan Issuance and the Event in China

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' 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 2.6 shows the de-trended[16] differences in bank lending between

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

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 confirms 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 2.6 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 the 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 quantity of new credit issuance, will also unintentionally lead to a larger gap in borrowing abilities between SOEs and POEs.

Reserve Requirement - Table 2.1 shows the development of the reserve requirement in China since 1985. This table illustrates how the regulators

[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.

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].

2.3 Evidence from a Simple VAR

Figure 2.7 and 2.8, present impulse responses (with 68 and 95 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

[18] see Table 2.2 for a list of the OMOs

[19] see Table 2.3 for a list of the central bank bills, designed to withdraw the liquidity in the system.

[20] These graphs are constructed following generalized impulse response function method in Pesaran and Shin (1998), therefore, I do not need to make any assumption on the ordering variables. However, similar result is obtained if instead using Cholesky decomposition assuming that the policy makers do not foresee the current period current account balance when they carry out policy interventions.

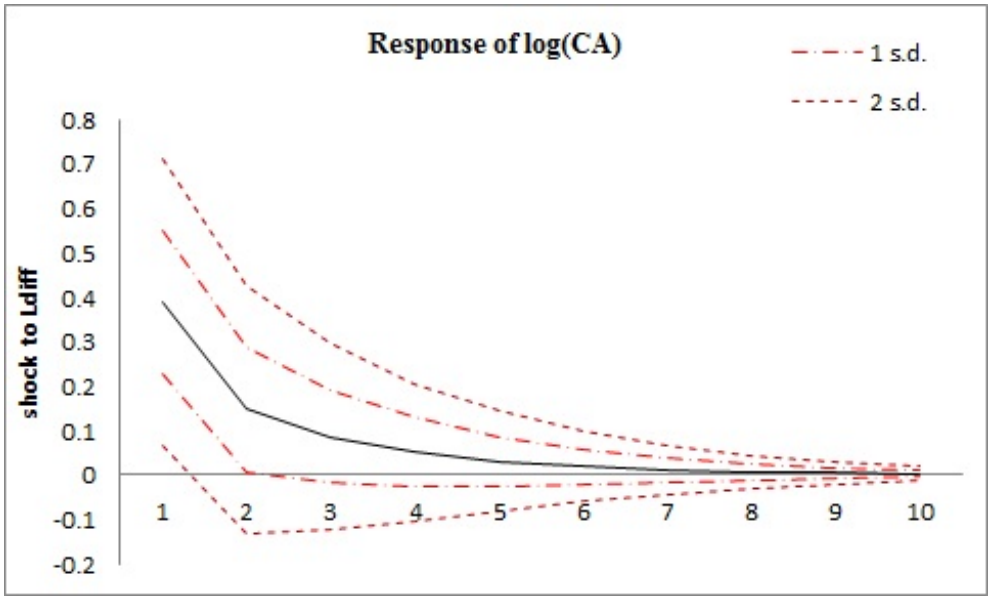


Figure 2.7: IRF 1 - Response of the Chinese current account balances to one standard deviation of loan issuance shock

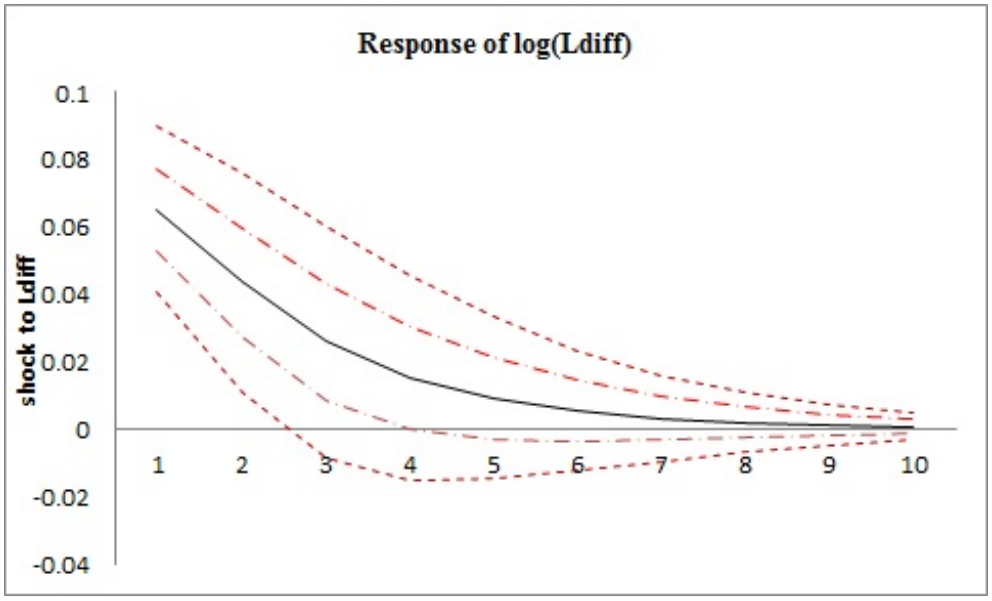


Figure 2.8: IRF 1 - Response of the differences between SOEs' and POEs' loan issuance to one standard deviation of loan issuance shock

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 2.19, 2.20 and 2.21 present impulse responses from a VAR with the log of US vs China bi-lateral current account balances(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 chapter, 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.

2.4 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:

$$\int_t^{\infty} logc(s,v) e^{(\tau+\rho)(t-v)} dv \tag{2.1}$$

subject to the dynamic budget constraint:

$$\frac{dw(s,t)}{dt} = (r_t + \rho)w(s,t) + a(s,t) - c(s,t) \tag{2.2}$$

which can be integrated to give:

$$\int_t^\infty c(s,v)e^{-\int_t^v (r(\mu)+\rho)d\mu}dv = w(s,t) + h(s,t) \tag{2.3}$$

So the optimal consumption path is:

$$c(s,t) = (\rho + \tau)(w(s,t) + h(s,t)) \tag{2.4}$$

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

where:

$$h(s,t) = \int_t^\infty a(s,v)e^{-\int_t^v (r(\mu)+\rho)d\mu}dv \tag{2.5}$$

• Aggregate Consumption.

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

Aggregating equation 2.4 across all agents in the economy at time t leads to:

$$C_t = \int_{-\infty}^t c(s,t)\rho e^{\rho(s-t)}ds = (\rho + \tau)(W_t + H_t) \tag{2.6}$$

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:

$$\begin{aligned} H_t &= \int_{-\infty}^t h(s,t)\rho e^{\rho(s-t)}ds \\ &= \int_t^\infty A_v e^{-\int_t^\mu (r_\mu+\rho)d\mu}dv \end{aligned} \tag{2.7}$$

Differentiate with respect to time:

$$\frac{dH_t}{dt} = (r_t + \rho)H_t - A_t \tag{2.8}$$

The aggregate wealth:

$$W_t = \int_{-\infty}^{t} w(s,t)\rho e^{\rho(s-t)} ds \tag{2.9}$$

Differentiating with respect to time gives:

$$\begin{aligned} \frac{dW_t}{dt} &= w(t,t) - \rho W_t + \int_{-\infty}^{t} \frac{dw(s,t)}{dt}\rho e^{\rho(s-t)} ds \\ &= w(t,t) - \rho W_t + (r_t + \rho)W_t + A_t - C_t \end{aligned} \tag{2.10}$$

to arrive at the second line, I used equation 2.4.

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

$$\frac{dW_t}{dt} = r_t W_t + A_t - C_t \tag{2.11}$$

Collecting equations:

$$\begin{aligned} C_t &= (r_t + \tau)(W_t + H_t) \\ \dot{H}_t &= (r_t + \rho)H_t - A_t \\ \dot{W}_t &= r_t W_t + A_t - C_t \end{aligned} \tag{2.12}$$

These equations reduce to:

$$\begin{aligned} \dot{C}_t &= (r_t - \tau)C_t - \rho(\rho + \tau)W_t \\ \dot{W}_t &= r_t W_t + A_t - C_t \end{aligned} \tag{2.13}$$

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 aggregating ω_B differentiated intermediate inputs.

$$Y_{B,t} = \Big(\int_0^{\omega_{B,t}} y_{B,t}(i)^{\frac{\theta-1}{\theta}} di \Big)^{\frac{\theta}{\theta-1}} \tag{2.14}$$

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:

$$y^*_{B,t}(i) = \frac{1}{\omega_{B,t}}\Big(\frac{p_{B,t}(i)}{P_{B,t}}\Big)^{-\theta}\bar{Y}_{B,t} \tag{2.15}$$

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):

$$P_{B,t} = \omega_{B,t}^{1/\theta}\Big(\int_0^{\omega_{B,t}}(p_{B,t}(i))^{1-\theta}di\Big)^{\frac{1}{1-\theta}} \tag{2.16}$$

• 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 y: $l = \frac{y}{\varphi}$. 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:

$$p_{B,t}(i) = \Big(\frac{\theta}{\theta-1}\Big)\Big(\frac{v_t}{\varphi(i)}\Big) \tag{2.17}$$

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

$$\begin{aligned}\pi_{B,t}(i) &= \Big(p_{B,t}(i) - \frac{v_t}{\varphi(i)}\Big)y_{B,t}(i) \\ &= \Big(\Big(\frac{v_t^{1-\theta}}{\theta-1}\Big(\frac{\theta}{\theta-1}\Big)^{-\theta}\Big)\frac{\varphi^{\theta-1}(i)}{\omega_{B,t}}P^{\theta}_{B,t}\bar{Y}_{B,t}\end{aligned} \tag{2.18}$$

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 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:

$$\delta\pi_\infty(i) - F_B \geq 0 \tag{2.19}$$

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

$$\pi_\infty(i) = \int_t^\infty \pi_s(i) e^{-\int_t^s (r(\tau)+\rho)d\tau} ds \tag{2.20}$$

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

$$\Pi_t = \int_0^{\omega_{B,t}} \pi_t(i) di \tag{2.21}$$

The reservation productivity ($\varphi^*_{B,t}$) at time t is determined at which the firm is indifferent between enter or not, therefore, all the potential entrants

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

[22]This condition requires $\pi_\infty(i) - F_B \geq 0$, since $\delta < 1$ 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.

with a productivity draw higher than $\varphi^*_{B,t}$, will decide to enter the production in intermediate good.

$$\delta_t \pi_\infty(\varphi^*_{B,t}) - F_B = 0 \tag{2.22}$$

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

$$\omega_{B,t} = 1 - G(\varphi^*_B) \tag{2.23}$$

Remark 1: Under this setting, as $\delta_t \to \infty$, that is $F_B \to 0$, 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 treated as constant across different firms despite their output and profit levels, seems at first instant implausible. However, letting the fixed entry cost vary with firm's profit level is equivalent to the situation with varying borrowing abilities 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 $\delta_t^{\frac{1}{1-\beta}} \pi_\infty(i) - (F^f)^{\frac{1}{1-\beta}} = 0$.

- Exit.

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

$$\pi_t(i) - f_t \geq 0 \tag{2.24}$$

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

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

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:

$$r_t V_t = \delta_t \Pi_t + \dot{V}_t \tag{2.25}$$

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.

$$\dot{W}_t = r_t W_t + A_t - C_t \tag{2.26}$$

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:

$$\int_0^{\omega_{B,t}} l(i)di = L \tag{2.27}$$

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

$$\int_0^{\omega_{B,t}} l(i)di = \int_0^{\omega_{B,t}} \frac{y_{B,t}(i)}{\varphi_t(i)} di \tag{2.28}$$

gives the equilibrium wage rate:

$$v_t = \Big(\frac{\theta - 1}{\theta}\Big)\Big(\frac{\alpha}{\alpha + 1 - \theta}\Big)^{\frac{1}{\theta}} \varphi^{\frac{\theta-1}{\theta}} P_{B,t} \bar{Y}_{B,t}^{\frac{1}{\theta}} \tag{2.29}$$

Given the wage rate, the aggregate household income at time t is the sum of the wage incomes, profits from intermediate firms minus the fixed investments.

$$A_t = v_t L + (1 - \delta_t)\Pi_t - \rho w_t F_B \tag{2.30}$$

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.

2.5 The World Economy

This section services two purposes: firstly, as the title suggests, 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

$$\dot{C}_t^j = (r_t - \tau)C_t^j - \rho(\rho + \tau)W_t^j \tag{2.31}$$

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:

$$C_t^j = (1/2(c_{Bh,t}^j)^{\frac{\theta-1}{\theta}} + 1/2(c_{Bf,t}^j)^{\frac{\theta-1}{\theta}})^{\frac{\theta}{\theta-1}} \tag{2.32}$$

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

$$c_{Bj,t}^z = \Big(\frac{P_{Bj,t}}{P_t^z}\Big)^{-\theta} C_t^z \tag{2.33}$$

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

$$Y_{Bj,t} = c^h_{Bj,t} + c^f_{Bj,t} \tag{2.34}$$

with the following price index P^j_t and $j = h, f$:

$$P^j_t = (1/2P^{1-\theta}_{Bh,t} + 1/2P^{1-\theta}_{Bf,t})^{\frac{1}{1-\theta}} \tag{2.35}$$

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 country j at time t.

$$P_{Bj,t} = \omega^{1/\theta}_{Bj,t}\Big(\int_0^{\omega_{Bj,t}} (p_{Bj,t}(i))^{1-\theta} di\Big)^{\frac{1}{1-\theta}} \tag{2.36}$$

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

$$\begin{aligned} \pi_{Bj,t}(\omega_{Bj}, \varphi(i), i) &= \Big(p_{Bj,t}(i) - \frac{v_{j,t}}{\varphi(i)}\Big) y_{Bj,t}(i) \\ &= \Big(\frac{v^{1-\theta}_t}{\theta - 1}\Big(\frac{\theta}{\theta - 1}\Big)^{-\theta}\Big) \frac{\varphi_{Bj,t}(i)^{\theta-1}}{\omega_{Bj,t}} (C^h_t + C^f_t) \end{aligned} \tag{2.37}$$

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:

$$\delta^f \pi^f_\infty(i) \geq F_{Bf} \tag{2.38}$$

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

$$\varphi^{f*}_t = \Big((\frac{\delta^f \kappa}{F_{Bf}}) \int_t^\infty (v^f_s)^{1-\theta} \omega^{-1}_{Bf,s} (C^h_s + C^f_s) e^{-\int_t^s (r_\mu + \rho) d\mu} ds \Big)^{\frac{1}{1-\theta}} \tag{2.39}$$

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

$$\dot{\varphi}^f_t = (\frac{\delta^f_t \kappa (v^f_t)^{1-\theta}}{F_{Bf} * (\theta - 1)}) * \omega^{-1}_{Bf,t} * (\varphi^f_t)^\theta (C^h_t + C^f_t) - \frac{r_t + \rho}{(\theta - 1)} \varphi^f_t \tag{2.40}$$

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

$$\omega_{Bf,t} = 1 - G(\varphi^{f*}_t) \tag{2.41}$$

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

$$\delta^{SOEs} \pi^h_\infty(i) \geq F_{Bh} \tag{2.42}$$

Gives:

$$\dot{\varphi}^{h*}_{\delta^{SOEs},t} = (\frac{\delta^{SOEs} \kappa (v^h_t)^{1-\theta}}{F_{Bh} * (\theta - 1)}) * \omega^{-1}_{Bh,t} * (\varphi^h_{\delta^{SOEs},t})^\theta (C^h_t + C^f_t) - \frac{r_t + \rho}{(\theta - 1)} \varphi^h_{\delta^{SOEs},t} \tag{2.43}$$

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

$$\delta^{POEs} * \pi^h_\infty(i) \geq F_{Bh} \tag{2.44}$$

Gives:

$$\dot{\varphi}^{h*}_{\delta^{POEs},t} = (\frac{\delta^{POEs} \kappa (v^h_t)^{1-\theta}}{F_{Bh} * (\theta - 1)}) * \omega^{-1}_{Bh,t} * (\varphi^h_{\delta^{POEs},t})^\theta (C^h_t + C^f_t) - \frac{r_t + \rho}{(\theta - 1)} \varphi^h_{\delta^{POEs},t} \tag{2.45}$$

Hence the equilibrium number of firms in home economy is:

$$\omega_{Bh,t} = 1 - q * G(\varphi^{h*}_{\delta^{SOEs},t}) - (1 - q) * G(\varphi^{h*}_{\delta^{POEs},t}) \tag{2.46}$$

World Asset Market

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

$$\dot{W}_t^j = r_t W_t^j + A_t^j - C_t^j \tag{2.47}$$

$$r_t V_t^j = \delta_t \Pi_t^j + \dot{V}_t^j \tag{2.48}$$

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:

$$W_t^w = W_t^h + W_t^f \tag{2.49}$$

$$V_t^w = V_t^h + V_t^f \tag{2.50}$$

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

$$V_t^w = W_t^w \tag{2.51}$$

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

$$\begin{aligned} CA_t^j &= \dot{W}_t^j - \dot{V}_t^j \\ TB_t^j &= P_{Bj,t} Y_{Bj,t}^z - P_{Bz,t} Y_{Bz,t}^j \end{aligned} \tag{2.52}$$

where $j, z = h, f; \;\; j \neq z$.

2.6 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.

2.6.1 A Calibration

I begin by discussing the parameter calibration in the home region. Preference parameters are standard, for simplicity I assume the intertemporal 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 entry and exit rate is calibrated to 5.5 percent, which was calculated as the (yearly) average of the firm's entry and exit rate in China between 2002 to 2006 from Brandt, Biesebroeck, and Zhang (2009)[26]. The initial fixed cost (F_B) is set to equal to 0.32 which is calibrated to the ratio between total fixed investment and 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, is 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 (2006)), to do so I assume the steady state interest rate to be around 3 percentage points, which implies a value of

[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.

$\delta^h = 0.12$.

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

2.6.2 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 temporarily to $\delta^{SOEs} = \delta^{POEs} = \delta^h < \delta^f$. 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 chapter 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[27] 2.22 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

[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.

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 these results, is the gap between home saving 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 (2006).

2.6.3 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 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 the asymmetric borrowing ability shock moreover 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

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

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[29] 2.9 2.10 and 2.11 illustrate the entire path following the asymmetric borrowing ability shock in the home economy. I explore the transmission paths in detail:

Immediately after the shock, SOEs' borrowing ability rises at the cost of fallen 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 limits 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 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 at its marginal cost, since

[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 chapter shows its impact on shaping global equilibrium is large in magnitude, therefore it is important to understand the mechanisms behind this effect.

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[31] (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 averaged POEs' productivities is higher than the fall in averaged SOEs' productivities 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.

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).

[31] In Figure 2.18 suggests that Chinese export is mainly driven by the POEs.

Furthermore, the higher consumption levels in the home region (together with 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 outflow 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 ability 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[32] 2.23 2.24 and 2.25, 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 base line results as shown above, 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.

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

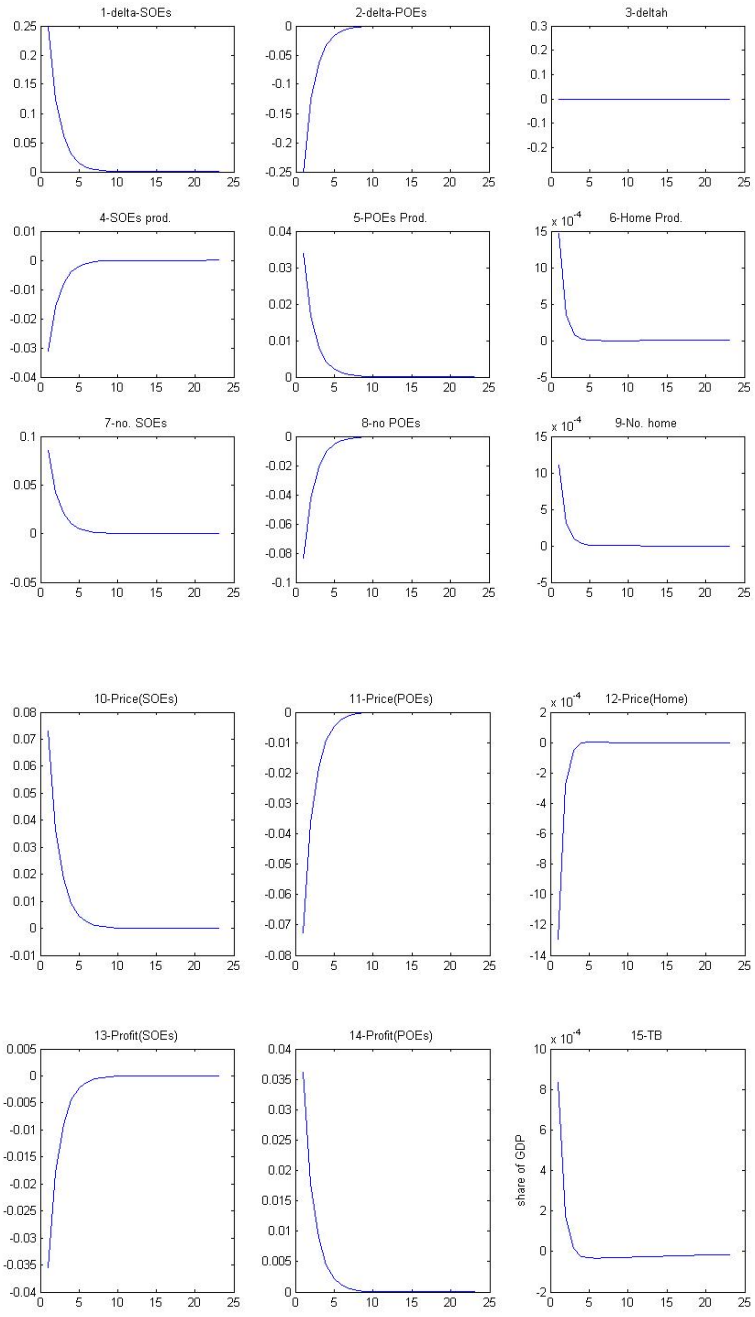


Figure 2.9: Equilibrium Path after an Asymmetric Borrowing Shock - 1

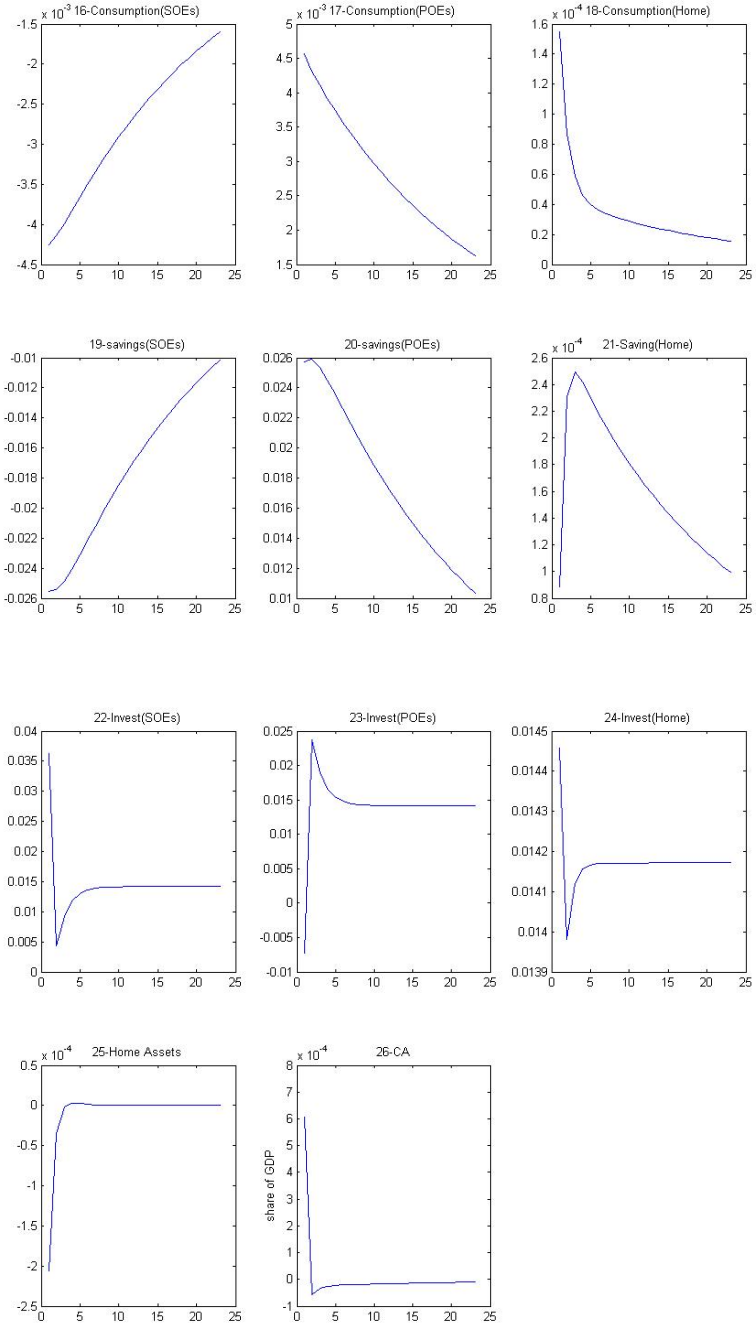


Figure 2.10: Equilibrium Path after an Asymmetric Borrowing Shock - 2

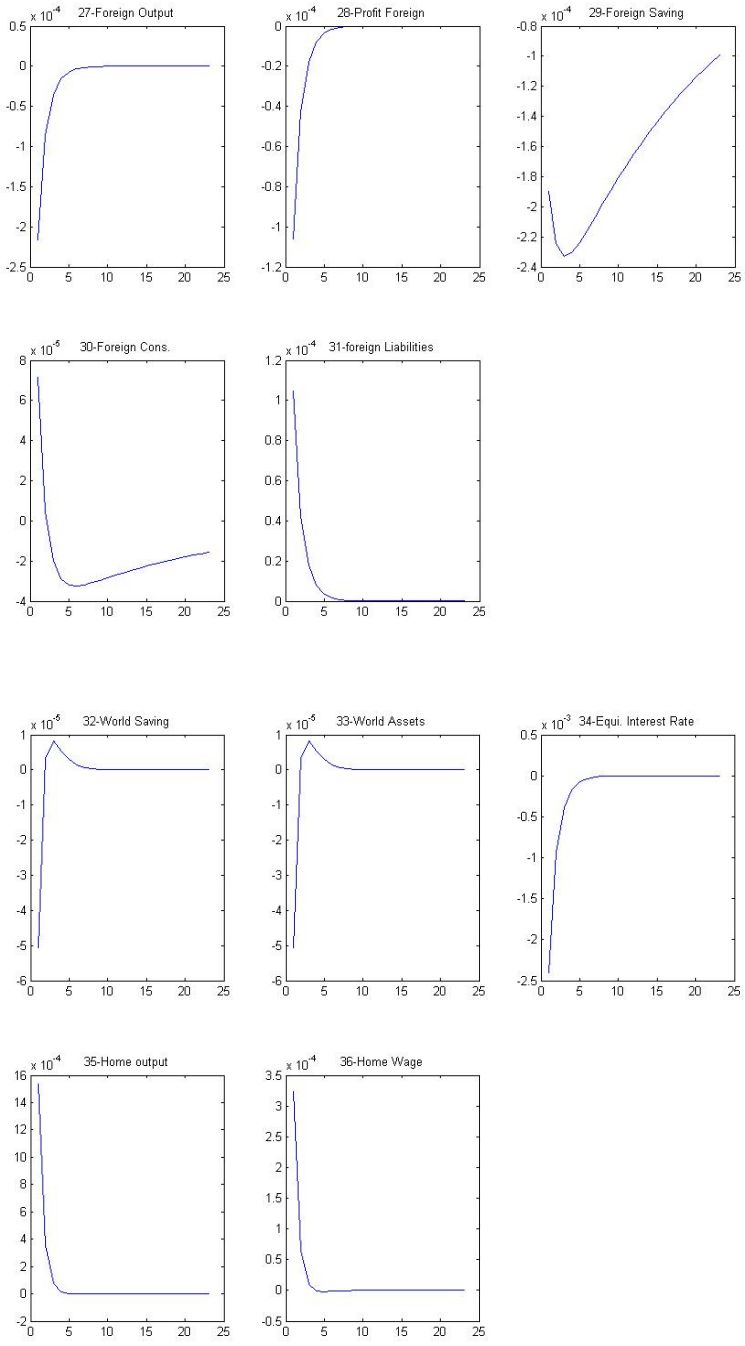


Figure 2.11: Equilibrium Path after an Asymmetric Borrowing Shock - 3

2.6.4 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 has improved 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 improve their borrowing abilities and POEs see their borrowing abilities fall, where the aggregate credit condition has improved after the shock ($\delta_s^h > \delta_t^h$)[33]. Additionally, I consider two more cases, where 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 exist after the asymmetric borrowing abilities shock (despite the improvement in aggregate financial market). Secondly, the results under all three different cases (see Figure[34] 2.26 2.27 and 2.28, 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.

2.7 Conclusion

In this chapter, 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.

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

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

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 (2006), although their main argument is the inability to supply financial assets, whereas in this chapter 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 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 chapter 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 chapter is the asymmetry between SOEs and POEs, by allowing both SOEs and POEs to grow will not change the main results, in fact, 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 chapter 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 chapter 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 chapter 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 chapter 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.

2.A Appendix

2.A.1 Tables

Table 2.1: Reserve Requirement Ratio in China 1985 - 2010

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

Source: People's Bank of China

Table 2.2: Open Market Operations in China 2000 - 2006

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

Note: This table shows number of OMOs within a year.
Source: People's Bank of China

Table 2.3: Issuance of Central Bank Bill in China 2000 - 2009

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

Source: People's Bank of China

2.A.2 Figures

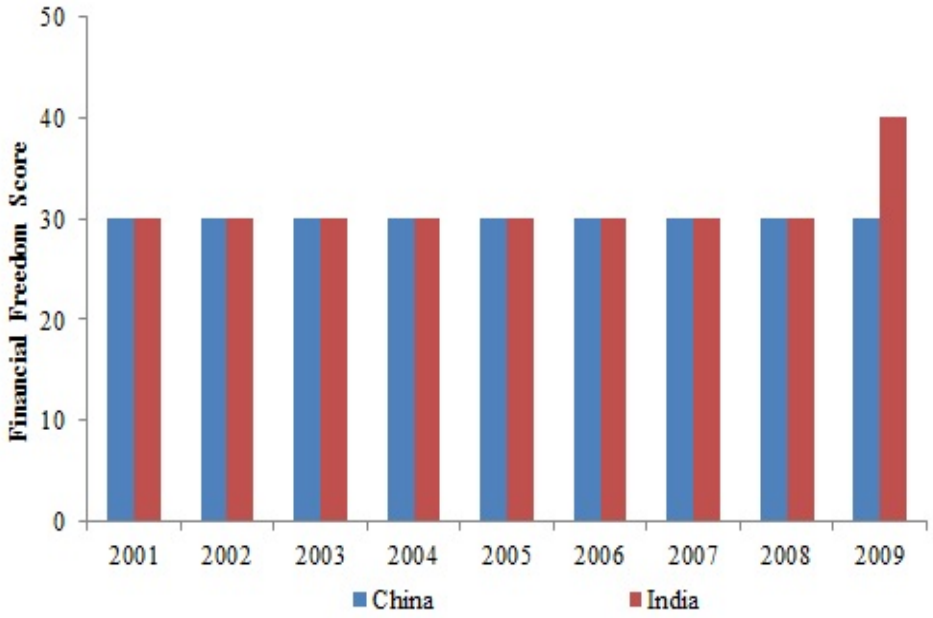


Figure 2.12: Ease of Doing Business Index

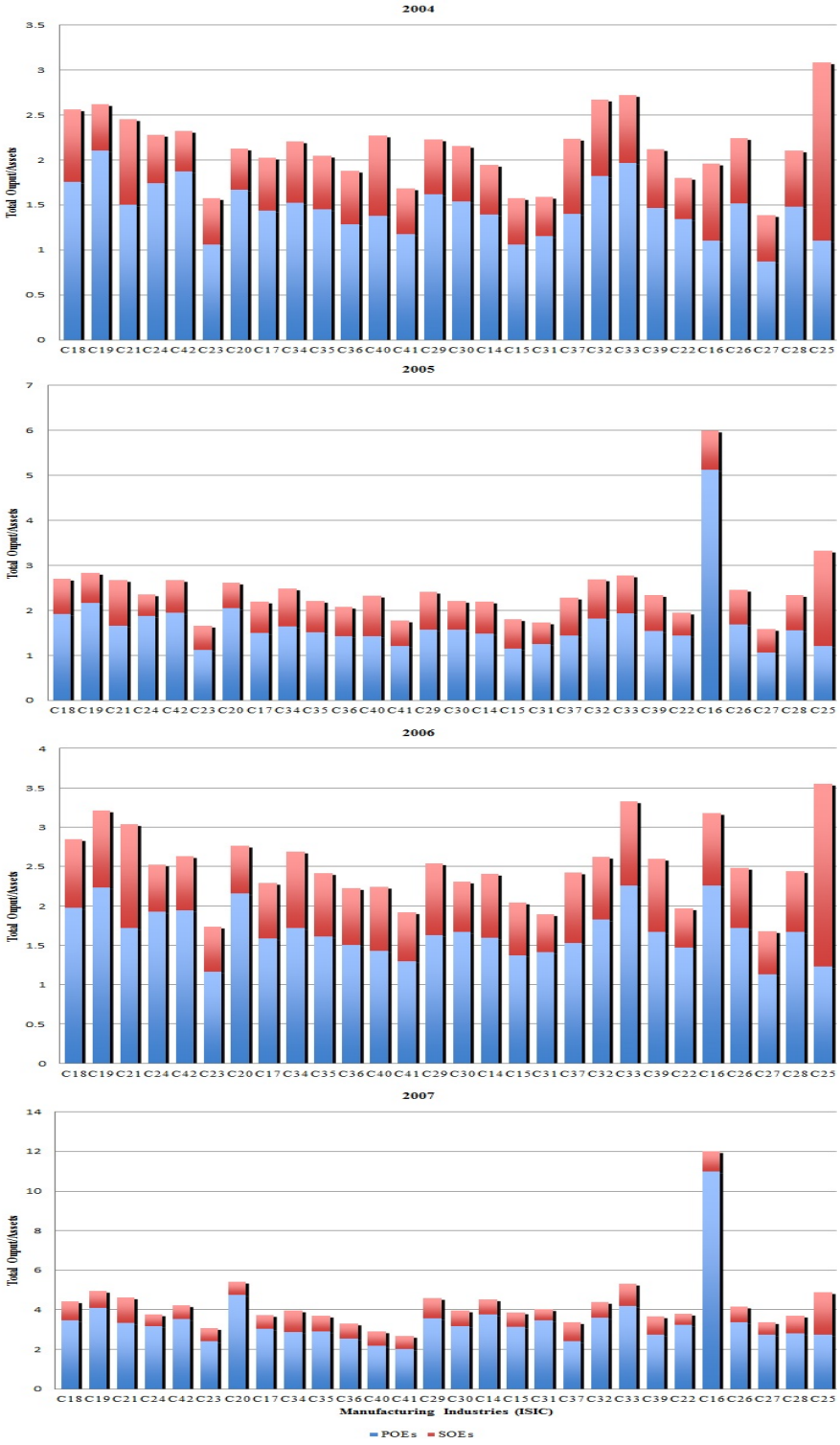


Figure 2.13: Productivity Comparison between SOEs and POEs Across 28 Manufacturing Industries in China

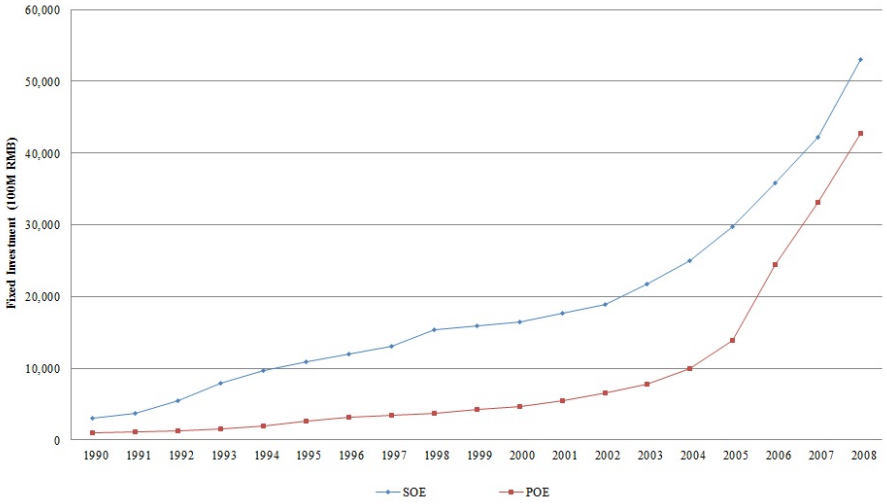


Figure 2.14: Fixed Capital Investment between SOEs and POEs in China

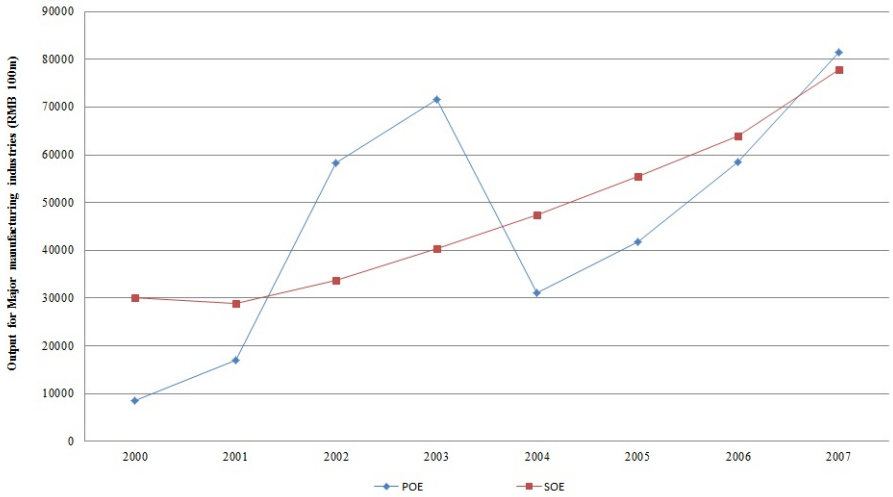


Figure 2.15: Total Output in Manufacturing Sector between SOEs and POEs in China

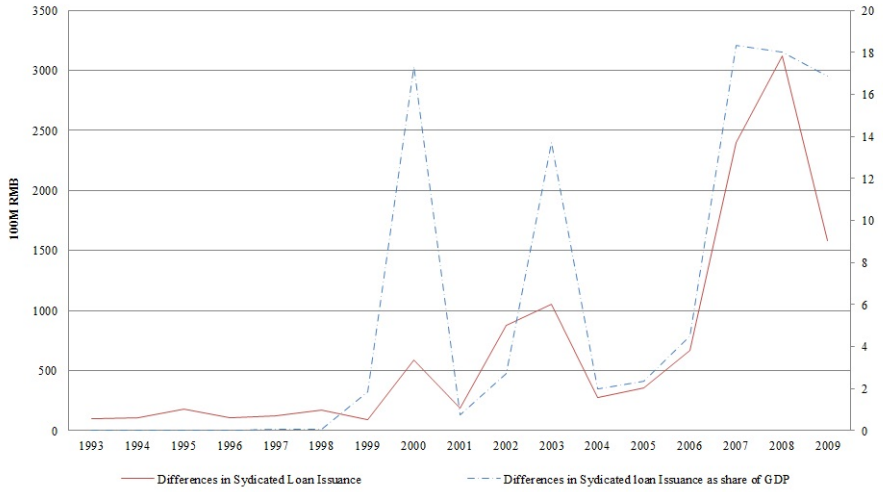


Figure 2.16: Differences Between SOEs' and POEs' Syndicated Loan Issuance in China

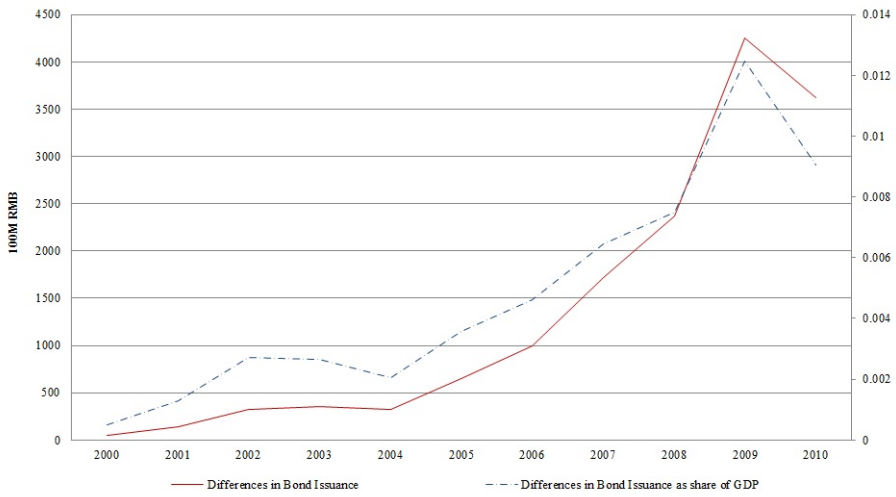


Figure 2.17: Differences between SOEs' and POEs' Bond Issuance in China

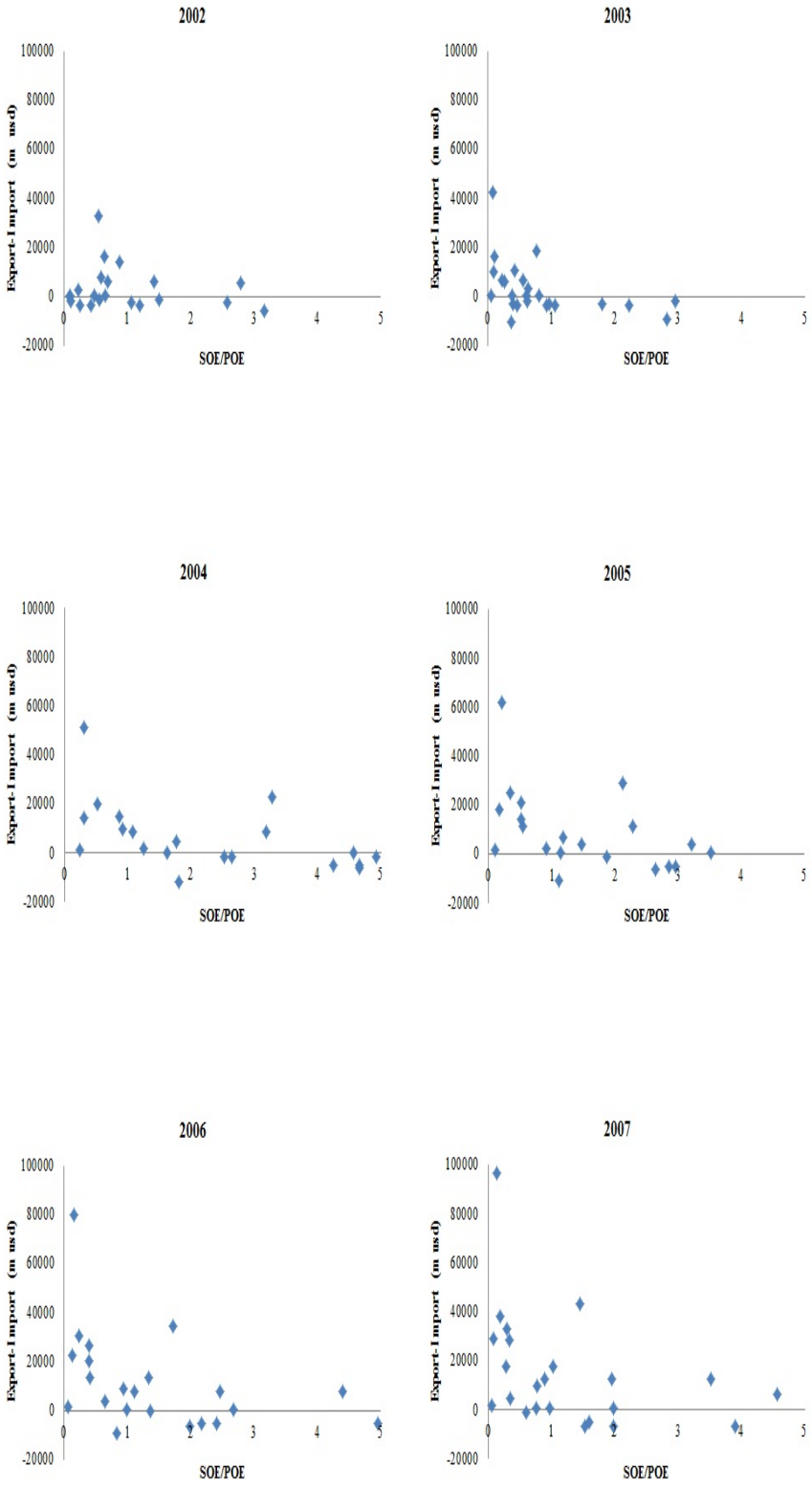


Figure 2.18: Trade Balance vs. share of SOEs Across 28 Manufacturing Industries in China

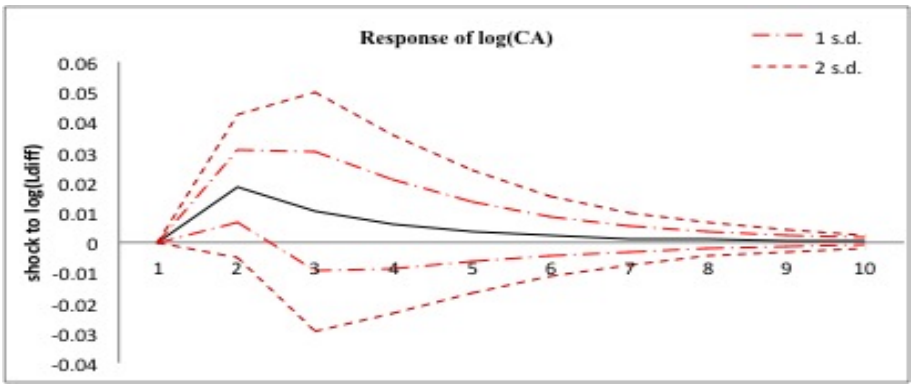


Figure 2.19: IRF 2 - Response of the China vs. US bilateral current account balances to one standard deviation of loan issuance shock

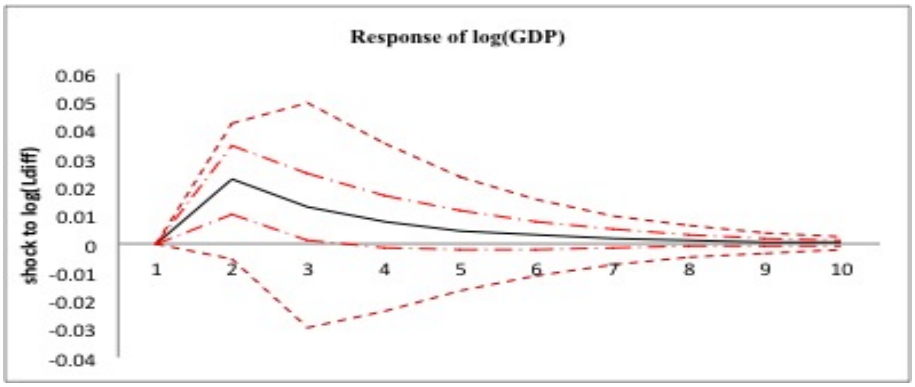


Figure 2.20: IRF 2 - Response of the Chinese GDP to one standard deviation of loan issuance shock

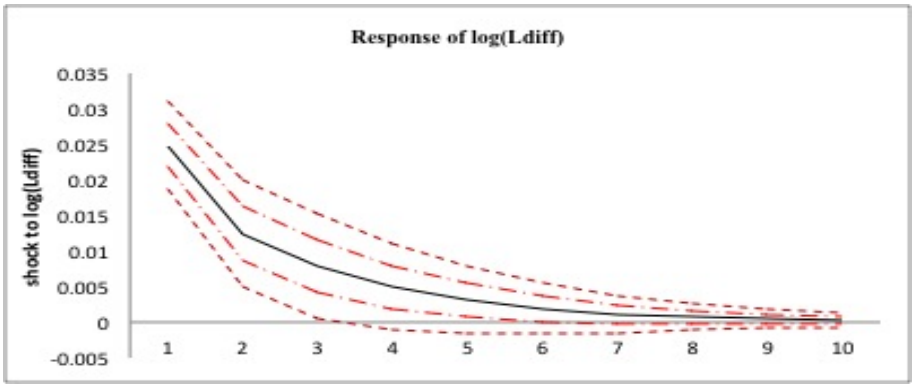


Figure 2.21: IRF 2 - Response the differences between SOEs' and POEs' loan issuance to one standard deviation of loan issuance shock

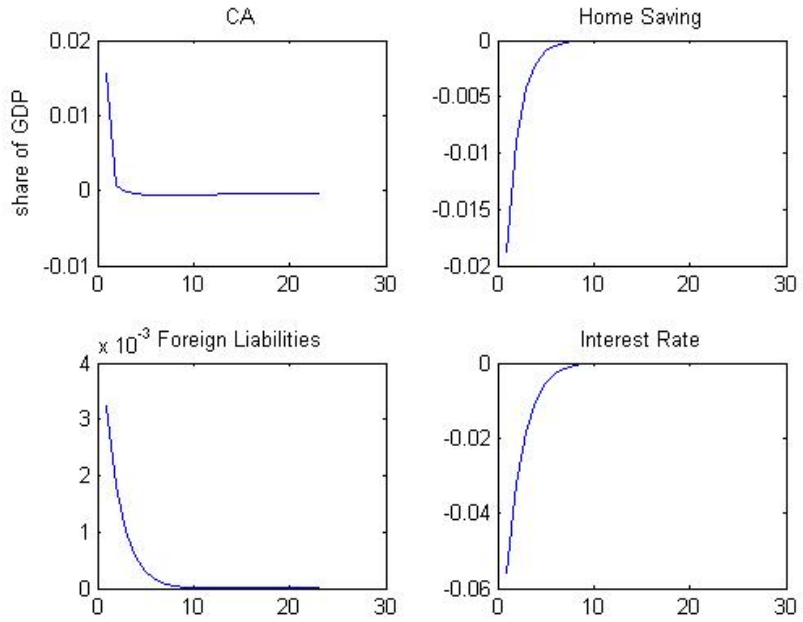


Figure 2.22: Equilibrium Path after a Borrowing Ability Shock

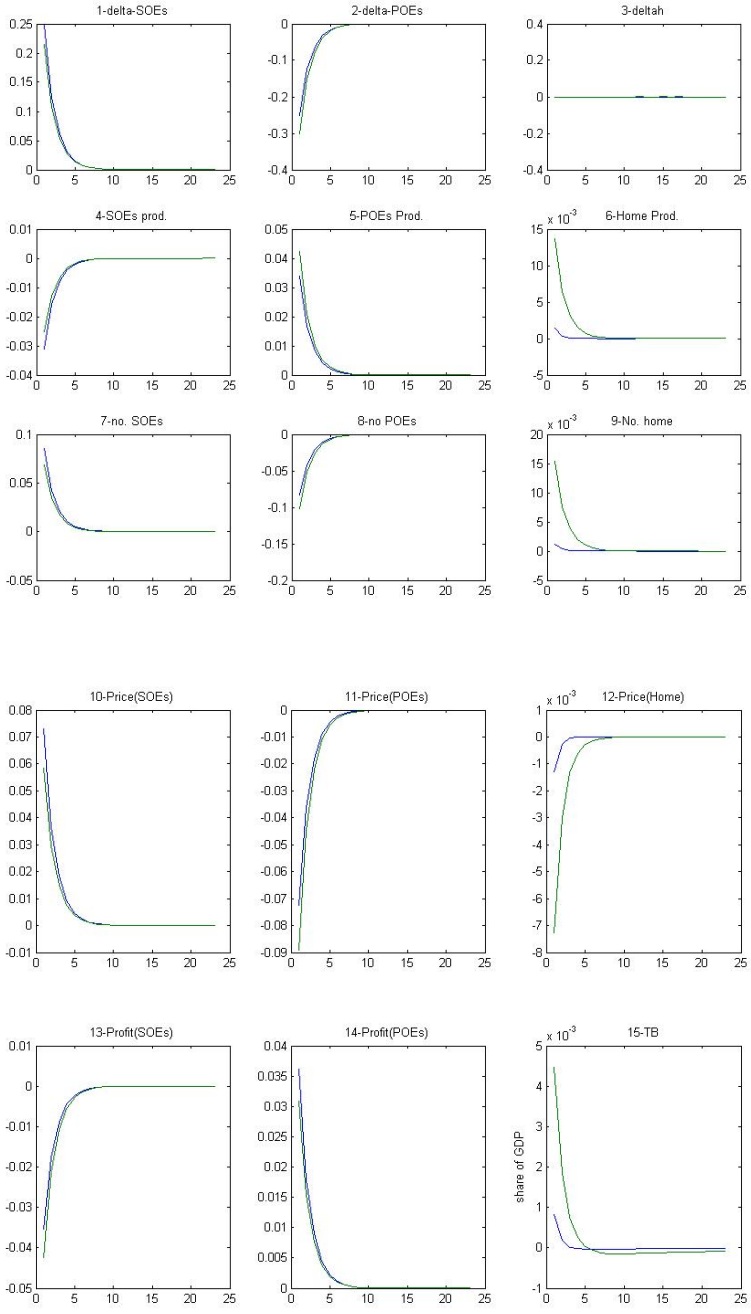


Figure 2.23: Trend vs. No-Trend - 1

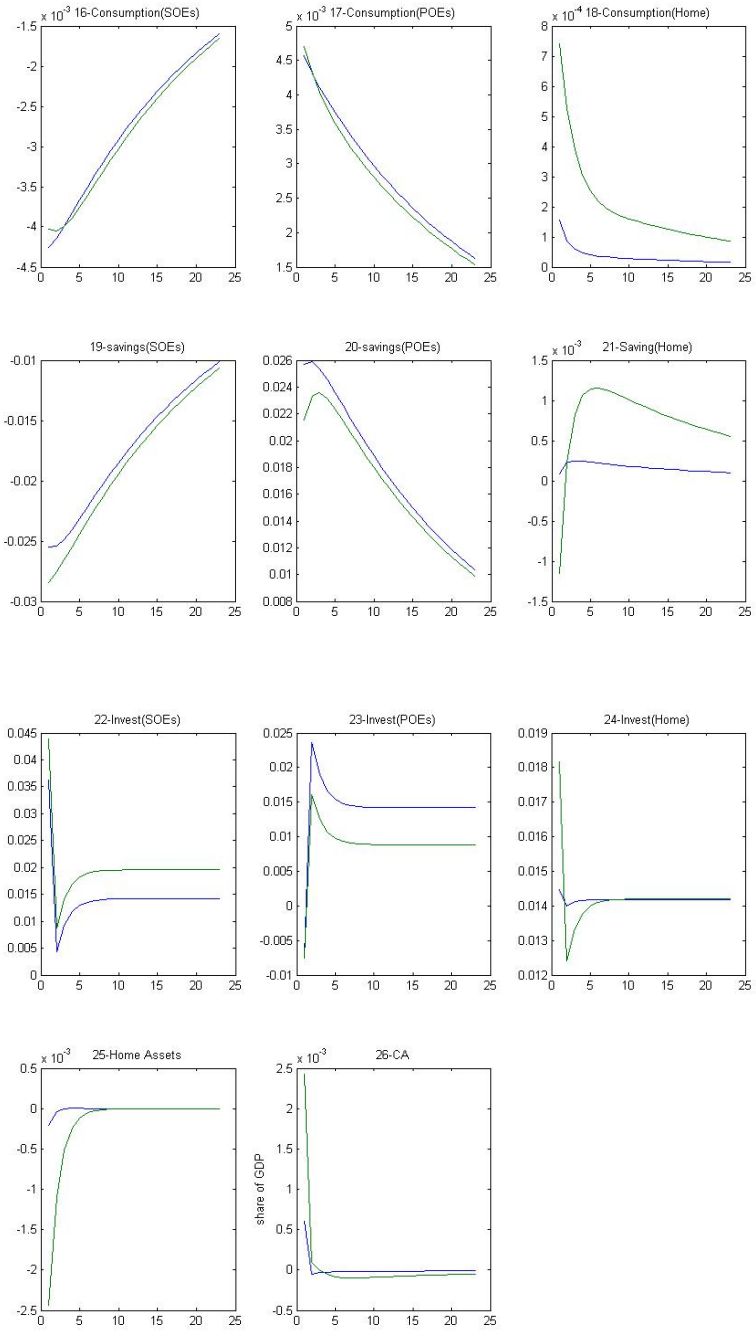


Figure 2.24: Trend vs. No-Trend - 2

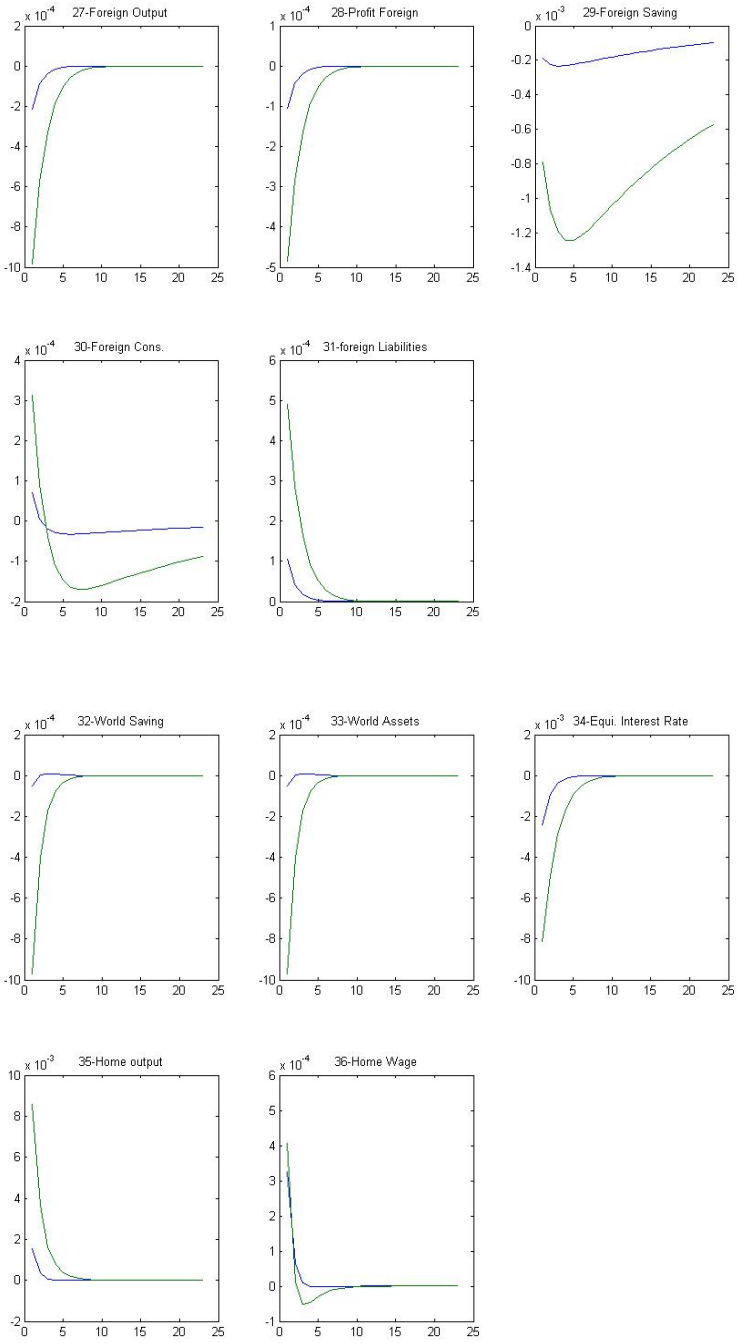


Figure 2.25: Trend vs. No-Trend - 3

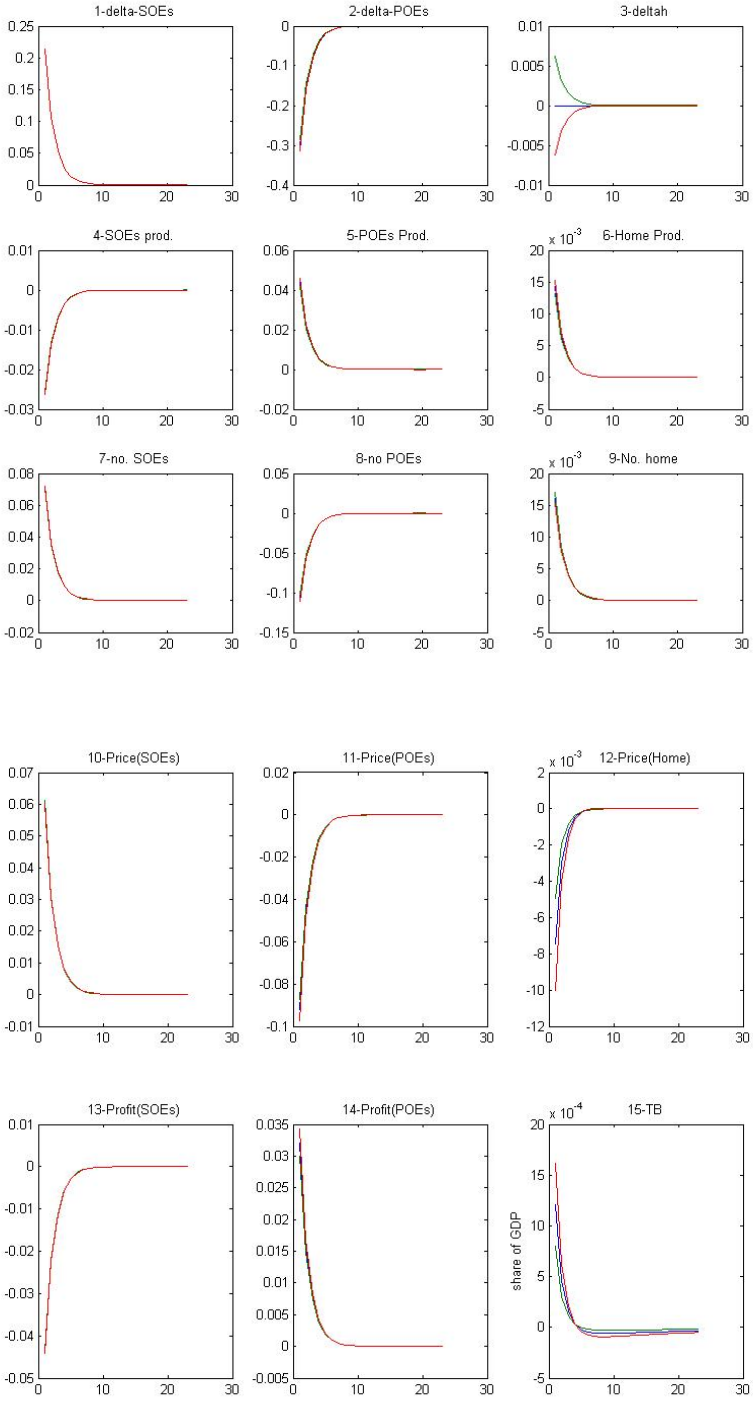


Figure 2.26: 3 Cases - 1

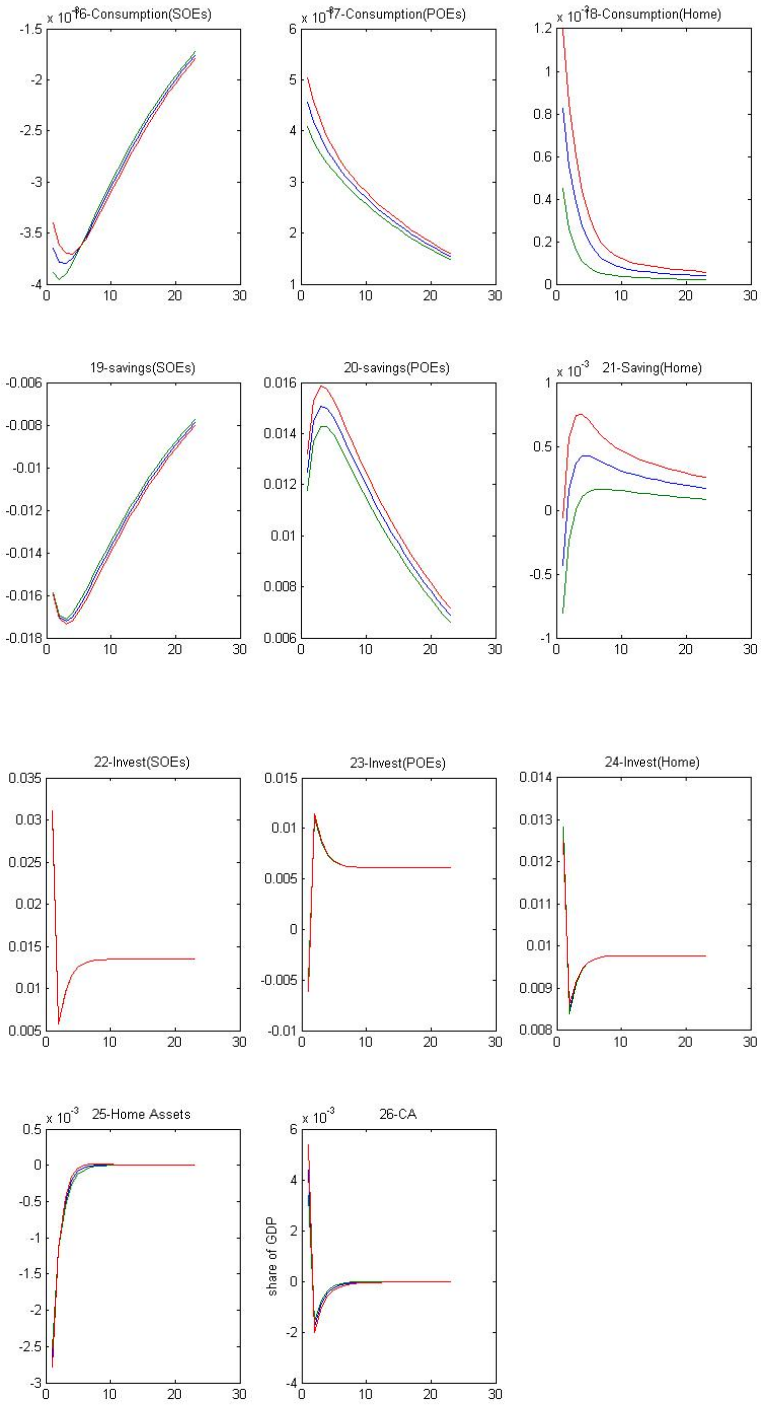


Figure 2.27: 3 Cases - 2

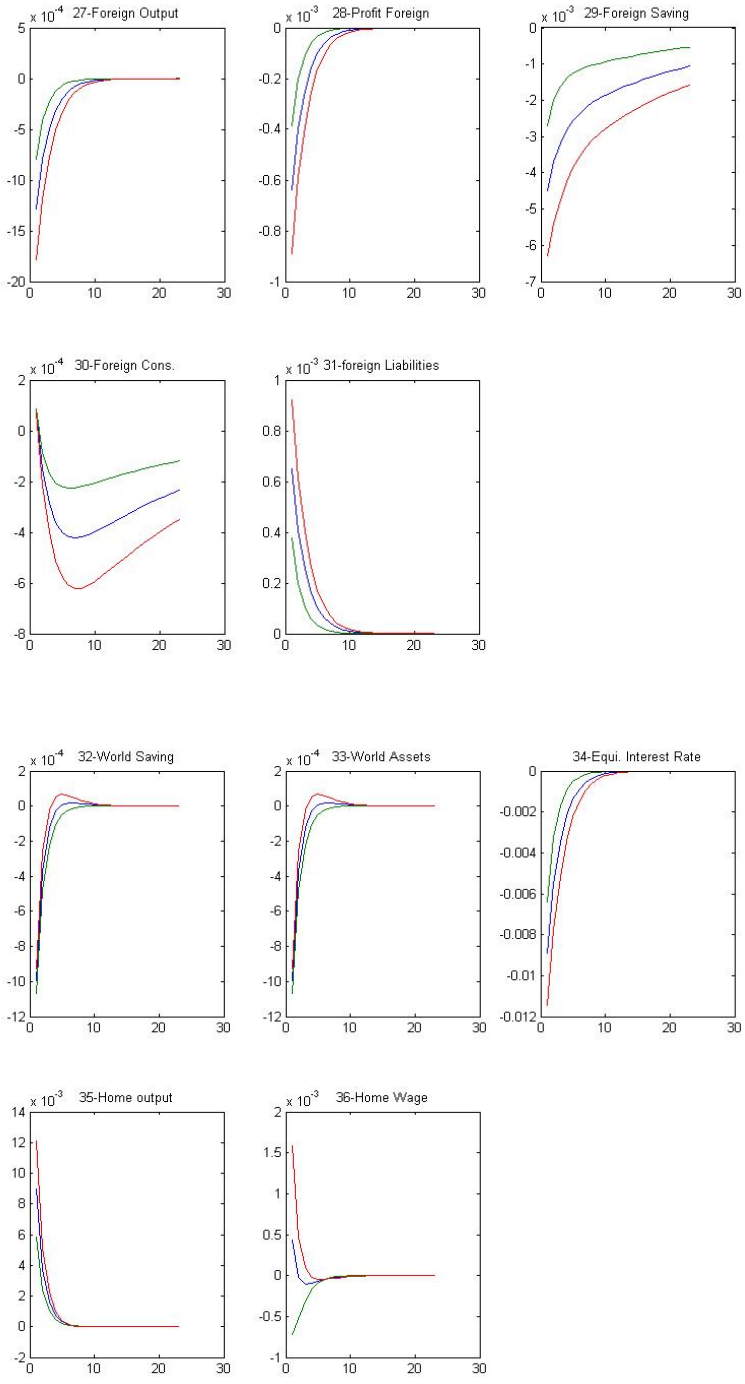


Figure 2.28: 3 Cases - 3

Chapter 3

Causes of Asset Shortages in Emerging Markets

3.1 Introduction

Capital markets in emerging markets (EMs) have expanded rapidly in recent years, with demand for assets expected to grow strongly for the foreseeable future. Following the 1980s crisis in Latin America and the 1990s crisis in East Asia, most EMs undertook bold reforms, encompassing fiscal orthodoxy, predictable monetary policies, and other structural reforms that led to a strengthening of the balance sheets of both the public and private sectors. The ensuing macroeconomic stability was not materially affected by the 2008 global credit crisis, with macroeconomic stability remaining intact and balance sheets still robust. Rising domestic savings - in the form of increasingly capitalized pension and mutual funds and reduced financing needs of public entities - and the increasing demand for EMs assets from local and foreign investors, insurance companies, and other financial intermediaries, have led to greater appetite for domestic equity, bonds, and other financial assets.

The paradox of the improved macroeconomic environment in EMs is that while savings have remained strong or even increased, the supply of financial assets has not risen commensurately. High equity returns, a stable macroeconomic environment and increasing assets under management by institutional investors have not led to the takeoff of the primary market in most EMs. Equity issuances/Initial Public Offerings (IPOs) are still infrequent, though there are regional variations (Figure 3.4). Whereas Asian companies tend to issue domestically, Latin American companies are biased toward raising capi-

tal overseas instead. Most domestic fixed income markets are highly underdeveloped and dominated by public debt; outside public short-term debt, most fixed-income products remain illiquid (de la Torre and Schmukler (2006)).

The constraint to expanding domestic assets is partly structural, related to market size. Outside the Brazil, Russia, India, and China (BRICs), most EMs are small economies, which limits the scope for deep domestic financial markets. The selective nature of issuers - mainly companies in the mining sector in Latin America or manufacturing companies in East Asia - restricts the benefit of diversification for investors. Corporate culture, such as the unwillingness to give up control, also plays a part in explaining why entities and controlling shareholders are reluctant to relinquish control over firms.

The lack of domestically investible assets, if not addressed, could potentially lead to large macroeconomic imbalances that threaten stability. A shortage of investible assets leads to excess liquidity that lowers interest rates and raises asset prices on equity and housing. Moreover, the dominance of buy and hold investors leads to fewer transactions, which raises the entry and exit costs into the stock market. In any case, share prices are not good indicators of actual market prices in illiquid and underdeveloped markets. They suffer from a shortage of information and high spreads, and are prone to be affected by noise traders and large swings in price volatility. The shortage of domestic financial assets, combined with investment restrictions abroad, could lead to bubbles with too much capital chasing too few assets. Market efficiency is also affected, as in a world of imperfect capital mobility - owing to investment restrictions misalignments in asset valuation relative to the economic fundamentals can be long lasting.

The chapter is structured as follows. In Section II, we describe asset shortages and their symptoms; in Section III, we discuss possible causes of asset shortages. The asset shortage index is constructed in Section IV, followed in Section V by an estimation of the factors driving asset shortages. Section VI concludes with policy implications.

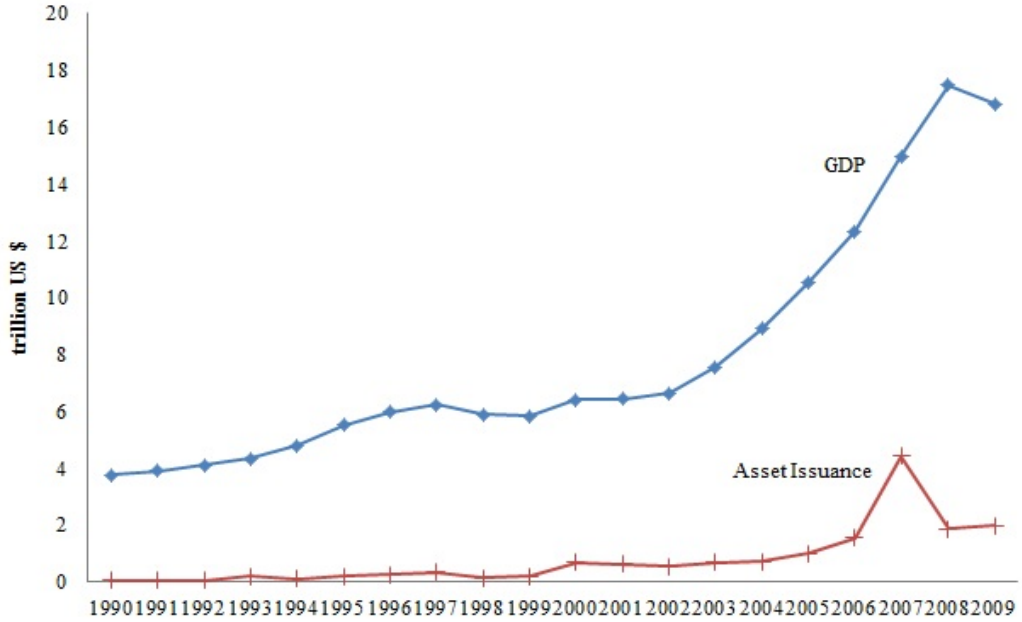


Figure 3.1: Asset Shortages in Emerging Economies

3.2 What are Asset Shortages and What are the Symptoms?

EMs are producing too few financial assets relative to rising saving levels, leading to asset shortages. This is not a new phenomenon. Other countries have been able to grow rapidly without issuing substantial amounts of financial assets, such as communist countries in the past or oil-producing nations today. Therefore, an economy's ability to produce output is only imperfectly linked to its ability to generate financial assets (Caballero (2006)). As illustrated in (Figure 3.1), although EM asset issuance, as a share of GDP, has increased since 1990, it is still low relative to GDP, and does not grow one-to-one with GDP.

For asset shortages to exist there must be market imperfections; otherwise interest rates would balance the supply and demand for assets. Either savings are not responsive to interest rates (and there is a lot of empirical evidence suggesting that savings are indeed highly inelastic relative to interest rates) or the supply of assets is not responsive to interest rates alone. Also, capital markets are subject to market inefficiencies - noncompetitive markets lead to high transaction costs, information asymmetry - and these problems are particularly severe in EMs. Moreover, in a theoretical setting Chapter 2 illustrates that existence of asymmetric borrowing constraints within the EM,

leads to supply of financial asset can not match up with the rate of demand increases, as a result asset shortages emerges.

Prior to the emerging market crises of the 1990s, EMs grew rapidly, with high savings rates accompanied by high investment rates. However, while savings rates have remained high, investment rates have started to decline following the Asian crisis, leading to a shortage of financial assets in these countries (Rajan (2006)). The shortage was exacerbated by the rapid growth of savings in China and in commodity producing countries that do not generate financial assets on a sufficient scale to satisfy demand for them (Caballero, Farhi, and Gourinchas (2006)).

Fewer investment opportunities in EMs have resulted in asset shortages, with negative implications for both the macroeconomy and financial markets. Investment opportunities have been restrained by the inability to issue financial assets in EMs. Emerging bottlenecks in capital markets, with too much money chasing too few assets, have given rise to some perverse consequences for market efficiency. These include:

- Low real interest rates. With too much savings chasing too few investments, real interest rates are kept low (by historical standards) (see also GFSR (2012)). Low interest rates are in turn pushing economic agents into higher-risk assets, searching for yields and bringing real interest rates down further.

- Illiquid capital markets in EMs. The lack of liquidity in many EM capital markets is a result of investors trying to grab any assets they can and holding on to them. The mismatch leads to buy and hold strategies by investors and concentrated ownership, leading to illiquidity in domestic capital markets (and lending itself to market misconduct and price manipulation).

- Misalignment in the valuation of assets, leading to bubbles in extreme cases. A mismatch between asset supply and demand may lead to sustained misalignments in asset valuation relative to the economic fundamentals. The recurrent speculative bubbles observed in EM economies are a reflection of these misalignments[1].

[1]While only anecdotal, the last few decades have seen increases in bubbles, which have become more frequent across more financial assets. Mexican and other Latin American debt suffered from a crash in 1982 and again in 1994; stocks of the Asian Tiger economies

- Capital flows from EMs to advanced economies (AEs). The Lucas paradox, that capital is flowing from EMs to advanced countries, is again a symptom of asset shortages in EMs. With a limited amount of assets to invest in, savers in EMs invest their savings overseas. Sovereign Wealth Funds (SWFs) are an extreme form of asset shortage, with massive savings in EMs not absorbed by the domestic economy, because of the lack of financial assets.

3.3 What Causes Asset Shortages?

Asset shortages have become severe in the last two decades in EMs, owing to a combination of (i) the dwindling supply of financial assets; (ii) the increased supply of domestic savings; (iii) regulatory restrictions; and (iv) other factors. Let us look at them in turn.

3.3.1 Dwindling Supply of Financial Assets in EMs

- *Fiscal improvements.* Government fiscal policy is a key source of the supply of financial assets. According to the 'Original Sin' line of reasoning (Eichengreen and Hausmann (1999); Hausmann and Panizza (2010)), most EM governments and corporations are unable to borrow in local currency, due to shallow domestic capital markets and the unwillingness of investors to fund large investments in an EM currency, with the side effect of leading to a lack of supply of domestic financial assets. Several EM countries have improved their overall sovereign debt management practices, by increasing the share of domestic-currency denominated debt. Nonetheless, although the issuance of domestic debt has recently increased thereby raising the supply of domestic financial assets, the original sin has declined only marginally and only in a few countries (Hausmann and Panizza (2010)). Given original sin, abstinence of debt has become an important strategy in EMs, with governments running orthodox fiscal policies, thereby supplying few financial assets.

came back to earth in 1997; China, and with it commodity prices, peaked in 2007, and prices have fallen since, before recovering more recently. EM stock, currencies, credit, and other commodities once operated in their separate kingdoms and followed their own rules. Now, given asset shortages, they increasingly are interlinked financial assets; and when one market expands with the inflow of money, many risky assets shoot upward simultaneously, forming synchronized bubbles.

- *High uncertainty.* EMs have been subject to severe and repeated shocks in the last two decades, most notably the Asian crisis, which created high risk averseness. Banking systems in Asia and Latin America have been highly regulated since, forced to keep high liquidity buffers and capital ratios, which has created a stable banking system, though also a conservative one often constraining credit growth. In addition, poor property rights, weak contract enforcement, and judicial arbitrariness are just a few problems that by increasing uncertainty, constrain investment and lead to low private rates of return (owing to low appropriability). While most EMs have made great progress in addressing these problems over time, this has not been enough to address asset shortages[2].

3.3.2 Increased Supply of Domestic Savings

- *Pension reforms in Latin America, increasing commodity prices in the Middle East and Africa, and rising savings in East Asia have contributed to an increasing supply of savings in EMs.* While one could have expected rising consumption levels and falling savings with rising income per capita, pension reforms and positive exogenous shocks in the form of rising commodity prices or rising demand for export products have tended to lead to high saving rates.

- *Underdeveloped capital markets.* Savings in EMs are motivated in part to fund lumpy physical investments, because underdeveloped capital markets require agents to save on a massive scale and over an extended period of time. As EMs industrialize, and as investment requirements increase substantially, credit constrained investors require ever larger savings to finance lumpy investments. Investors have to accumulate a large share of the savings before they can ever invest, leading to an increase in domestic savings.

3.3.3 Regulatory Restrictions

- *Regulatory restrictions on agents.* A substantial portion of the world's desired savings are put to work by governments, central banks, and fi-

[2]Past investment excesses. One argument, advanced by Rajan (2006), is that past booms are still working themselves through the system. Following past over-investment, the investment overhang still needs some time to pass through the system. In other words, past mis-allocations of investment are still haunting current investment expenditure. Corporations are therefore cautious in their investment strategy to avoid over-investment. While there is some plausibility to this argument, it is a temporary phenomenon.

nancial institutions like insurance companies. Many of these agents are ordered by law to buy fixed-income products, such as domestic government bonds, and are constrained in regard to investments in certain assets classes, including foreign assets.

Regulatory Restrictions of Latin American Pension Funds

Chile[3] was the pioneer in pension reform in Latin America, and its model was copied throughout Latin America. In 1981, a comprehensive change took place in the pension system, changing the state-run, defined-benefit scheme to a defined-contribution system managed entirely by the private sector (by pension management companies called "AFPs"), under the supervision of a dedicated government agency, the Superintendency of AFP. Chile introduced mandatory individual savings accounts in the early 1980*s*; later, Argentina, Bolivia, Colombia, Ecuador, Mexico, Peru, and Uruguay followed suit, borrowing heavily on the Chilean model (Borensztein, Cowan, Eichengreen, and Panizza (2008)).

The system's investment opportunities are heavily regulated. The regulator of pension funds in all these Latin American countries sets strict regulations on foreign exposure, ranging from single-digit limits to about one-third of the funds. Both foreign and domestic fixed income investments typically are restricted to high-grade entities, funds for the government, and local blue-chip companies. Exposure to equity is also highly restricted, again only to blue-chip companies. Pension fund investments have given rise to abnormally low corporate bond spreads, well below sovereign spreads. The upward trend in stock prices is attributed partly to the demand exerted by these pension funds. This brings about some perverse consequences for market efficiency: prices may become misaligned from fundamentals; and liquidity is continually drained from the market place.

Restricting investment opportunities for pension funds reduces the investment universe. The limits might have been set on the grounds that (i) pension funds should rejuvenate anemic local financial markets; (ii) emerging markets are financially constrained and hence should not be

[3]See Table 3.3, 3.4, 3.5, 3.6, 3.7 and 3.8

capital exporters; and (iii) pension fund managers and supervisors are unfamiliar with external investment opportunities, exacerbating portfolio risk and moral hazard. These motives increasingly do not hold sway, and if not reformed, could lead to rising asset shortages. First, the overarching goal of any funded pension system is to maximize old-age retirement wealth at tolerable risk levels. This goal should not be subordinated to other commendable objectives. Local markets are poorly correlated with international markets, thus diversification is likely to pay off in the long term. Second, for crisis prone economies, domestic systemic risk makes it advisable to partially rely on more stable markets, provided efficient risk management policies are in place in every AFP. Finally, it is not necessary for the pension fund manager to deal with foreign asset selection directly, because many reputable international global fund managers with excellent track records can be hired at low cost, as they are in many countries.

The limit on foreign investment and risky domestic investable securities could be further relaxed from the current levels to reduce asset shortage problem. There is strong evidence internationally that home bias tends to result in strong sub-optimality of portfolios. Thus, it is not possible to justify a limit on foreign investment on economic grounds. Ideally, limits should be lax enough to allow AFPs to use less restrictive risk management policies and to eliminate the apparent excess demand for local financial instruments. Public offerings have not shown the expected dynamism and have largely lost their desirable characteristics (efficient pricing and liquidity). Asset-backed securities on mortgages and other receivables, real estate, and infrastructure projects should be given priority.

- *Regulation restricting supply of risky financial assets.* Many EMs (e.g., China) do not allow issuance of high-yield debt or other non-plain vanilla financial assets. This prevents the development of a whole asset class in such countries, thereby restricting the supply of financial assets.

- *Asymmetric financial markets.* As argued in Chapter 2, policy interventions (or its unintended consequences see Chapter 2) which favor (or discriminate) a certain set of firms in accessing to domestic credit market can distort the equilibrium between demand and supply of the financial assets. In particular these policies reduce the ability of asset

supplier in issuing financial assets, lead to asset shortages in domestic economy.

3.3.4 Other Reasons for Asset Shortages in EMs

- *Home bias (for political reasons).* While investors in EMs often are keen to invest their assets overseas as a store of value, worsening macroeconomic conditions of advanced economies in recent years, compared to EMs, has made it increasingly risky to invest in these regions, as epitomized by the recent crisis. Also, from the Balassa-Samuelson effect[4], we know that EMs should expect their real equilibrium exchange rate (REER) to appreciate over time, meaning that overseas investment in AEs will be subject to capital losses arising from exchange rate appreciation. Finally, the investments of Middle Eastern and Chinese investors in AEs are being increasingly scrutinized, thereby creating considerable uncertainty (as epitomized by the failure of Dubai World and CNOOC to acquire Western assets owing to political opposition). Such uncertainty has made investment overseas less attractive, thereby reducing access to an important asset class.

- *Increasing appetite for EM assets by AEs.* As part of portfolio diversification, advanced country portfolio managers have been increasingly investing part of their portfolios in EMs, thereby reducing the supply of domestic financial assets available to EM domestic investors.

3.4 Asset Shortage Index

We define our asset shortages index by capturing the difference between demand and supply for financial assets. Domestic demand for assets (latent asset demand) is proxied by gross domestic savings (i.e. all the resources available to invest), while the supply of financial assets is defined as domestic issuance of bonds, loans, and equity, as well as the net purchase of foreign assets and domestic assets by foreign investors. In addition, the change in short term deposits also is considered to be adding to the supply of financial asset, because it reflects the temporary parking of funds, which could be motivated

[4]The Balassa-Samuelson effect postulates that if the productivity growth differential between the traded and non-traded goods sectors is larger in the developing countries than in advanced ones, then the relative price of non-traded to traded goods will be rising faster in the developing than in advanced countries, leading to an exchange rate appreciation.

by a willingness to hold liquid assets as a precaution.

The supply of financial asset is modeled in the same spirits as discussed in other chapters of the current thesis as well as in Caballero, Farhi, and Gourinchas (2008). Broadly speaking these papers defined the supply of financial asset as $V_t = \delta PV_t$, where PV_t denote the present value of the economy's future output, and the parameter δ represents the share of PV_t that can be capitalized today and transformed into a tradable asset hence the total asset issued in domestic economy. The δ parameter captures the level of financial development in an economy, intuitively for a given level of future output, a higher δ implies domestic agent (enterprise, government or household) can borrow more against their future income, this is equivalent as saying agents can issue more financial assets (Bond, Equity and Loans).

To estimate our asset shortages (AS) index, we use the following formula:

$$AS = 1 - \Big(\frac{B + E + L + \Delta S.D. + NPFA}{S}\Big) \tag{3.1}$$

where S=domestic national savings, B=bond issuance in the domestic market, E=equity issuance in the domestic market, L=loan issuance in the domestic market, and S.D.= short term deposits. NPFA= net purchase of foreign financial assets by domestic residents, which reflects the position of domestic investors' holdings of foreign assets (debt, equity, financial derivatives and other investments) minus the net position of foreign investors' holdings of domestic assets. The sum of $B + E + L + \Delta S.D. + NPFA$ is therefore a reflection of the supply of financial assets.

3.4.1 Flow of Funds of Assets

Figure 3.2 illustrates the foundation of the asset shortage index, in which household savings is being invested in either liquid or non-liquid financial assets. On the demand side, enterprises, government and households issue new loans, bonds, or equity to finance their real investment project (or consumption), ranging from a new mortgage to a new enterprise. Alternatively, they finance projects either by reducing short-term assets or through foreign borrowing. According to the system of national accounts, the national financial account comprises seven categories of investment assets: (1) monetary gold; (2) currency and deposits; (3) securities other than shares; (4) loans; (5) shares and other equity; (6) insurance technical reserves; and (7) other

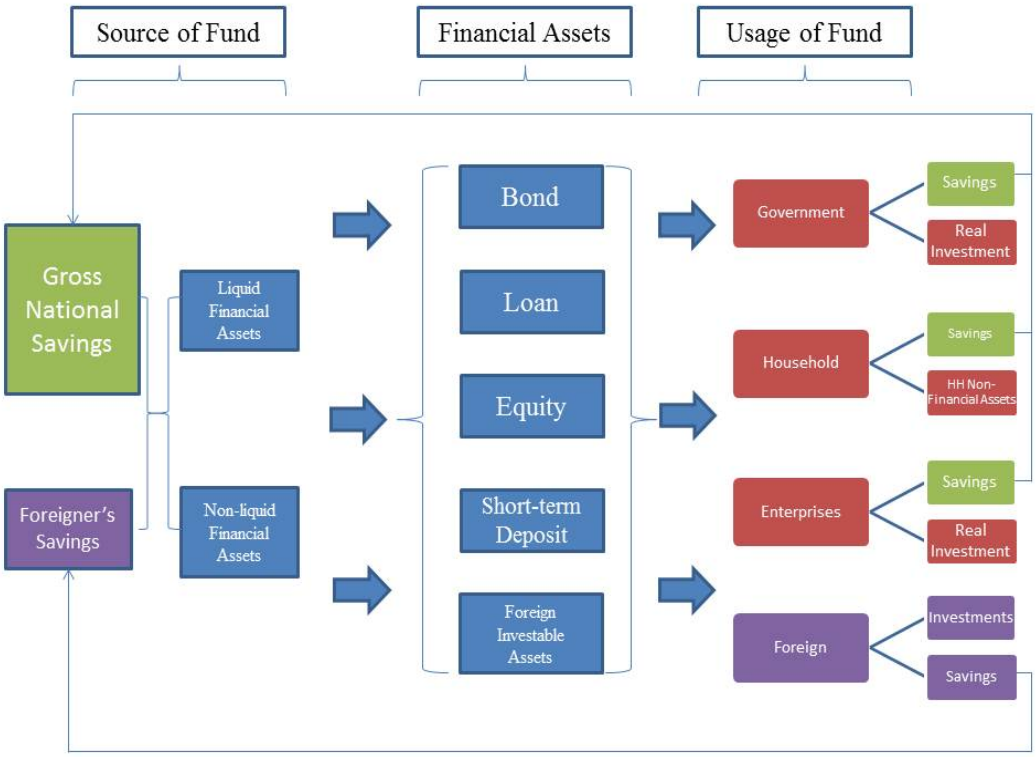


Figure 3.2: Flow of Fund

accounts receivable. In our asset shortage index, we have captured the currency and deposits, loans, and shares and other equity. The remaining terms, for the purposes of the AS-Index are unlikely to be significant. For example, monetary gold is mainly an investment option for the central banks. Also, the level of monetary gold reserves in the central bank does not vary from year to year, so in the overall economy monetary gold has very little relevance to asset shortages. Insurance technical reserves are very small in EMs, and data limitations made it impossible to include it in our index. Other accounts receivable is in general small in EMs; limited and underdeveloped credit ratings data make it difficult for companies to assess the risk of lending. Moreover, the duration of such a transaction is very short, limiting its importance.

3.4.2 Construction of the Index

Using available data, the asset shortage index for 41 EMs was constructed from 1995 - 2008[5]. Depending on the issuing country and issuing market, we

[5]The EMs are Argentina, Brazil, Chile, Colombia, Mexico, Panama, Peru, Venezuela, China, Hong Kong, India, Indonesia, Korea, Malaysia, Philippines, Taiwan, Thailand, Vietnam, Bahrain, Egypt, Israel, Kazakhstan, Kuwait, Morocco, Pakistan, Saudi Arabia,

combined a number of databases to obtain the most comprehensive data set that is consistent across countries. The variables used to construct the Asset Shortage Index are as follows:

- Gross national savings. The data for gross national savings reflect gross national disposable income subtracted by total expenditure; it represents economic resources available for investment. The dataset on gross domestic savings was obtained from the World Development Index (WDI) or was constructed from the World Economic Outlook (WEO) when WDI data were not available.

- Bond, equity, and loan issuance. Dealogic records all the domestic issuances of bonds, equity and syndicated loan. In this chapter, as a starting point, we use syndicated loan data as a proxy for the total loan issuance[6] because: 1, it is already difficult to obtain gross loan issuance data for advanced economies and this task became 'mission impossible' in EMs; 2, a series of recent papers have emerged, which use syndicated loan issuance data to study the properties of the loan market (i.e. Sufi (2007)); 3, the short term deposit is included as part of the asset supply which reflects large share of the unaccounted (by syndicated loan) gross loan issuance. For each country, the bond, loan and equity issuances were aggregated for each year.

- Net purchase of foreign financial assets. In an open economy, when a domestic resident purchases assets overseas (debt, equity, financial derivative, other investments), it represents an increase in the supply of financial assets for the domestic investor. Similarly, when a foreigner buys domestic assets, this is equivalent to a reduction in domestic financial assets available to domestic investors. Foreign institutional investors' interest in emerging markets has surged in recent years, because of improved sovereign liability management, resulting in a secular increase in demand for both external and local EM asset classes. Increases in privatization, improvements in investment climate, and easing of capital account regulations, resulting in a rapid rise in the share of the investable portion of the local equity market, have also attracted

South Africa, Turkey, UAE, Bulgaria, Croatia, Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovak Republic, Slovenia, Ukraine.

[6]As a robustness check, we also used loan stock data (from Bankscope) to construct a proxy for gross loan issuance, the implied asset shortage index is 'similar' to the one constructed using syndicated loan data therefore they are not reported in the current chapter.

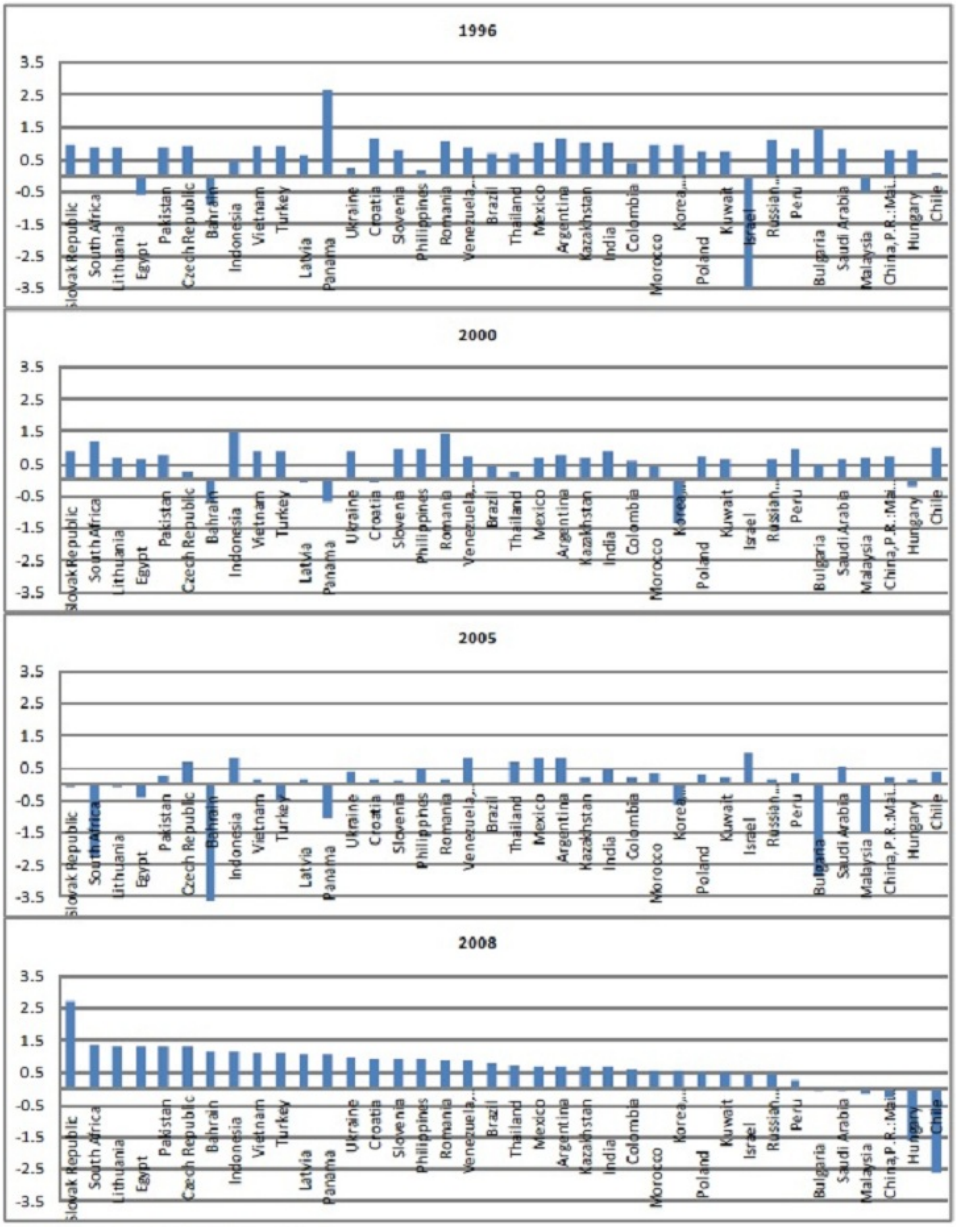
foreign institutional investor participation. Data for net purchase of foreign financial assets are obtained from balance of payment statistics.

- Change in short-term deposits. Part of an economic agent's assets is parked in short-term deposits, as a precaution against uncertainty, for instance. Investors can temporarily park funds as short-term deposits, creating a temporary investment vehicle. Data for short-term deposits are obtained from Bankscope, which aggregates all the banks' balance sheets to construct short-term deposits in an economy.

It is clear from the asset shortage index that, in recent years, asset shortage has become a rising issue in EMs, with few countries left out (Figure 3.3). The four snapshots 1996, 2000, 2005, and 2008 indicate that asset shortage is a general EM problem, with slight regional variations (e.g., the Middle East, which benefited from the oil windfall, and East Asia, which benefited from the manufacturing boom) and with some variations over time.

Issuance of financial assets has been on an upward trend regionally - until the recent crisis - but with low levels relative to GDP (negative numbers mean that the reduction in cash deposits outweighs issuance of bonds, equity, and loans). Regional variations are striking. East Asia, the Middle East, and Africa appear to have the highest issuance of financial assets, while Latin America and Eastern Europe lag behind (Figure 3.4).

Bond and syndicated loan issuance has been the principal source of financial assets in EMs, with equity issuance starting only in the mid-2000s. While the Asian crisis has dented some of the supply of bonds, in the last decade there has been a rise in both domestic bond issuance and syndicated loan issuance, though the latter has seen a sharp fall during the global crisis. Equity issuance, on the other hand, started growing rapidly only in 2005, from very low levels, and was negatively affected by the crisis. Net purchase of foreign financial assets, while initially positive, has turned negative in recent years as domestic investors have started to pick up foreign financial assets, suggesting that foreigners are buying relatively more domestic financial assets (Figure 3.5, 3.7, 3.6, 3.8 and 3.9).



Source: Dealogic, WEO and WDI

Figure 3.3: Asset Shortage Index

3.5 Empirical Estimation

3.5.1 Methodology

We will proceed by estimating the determinants of the asset shortage (AS) index. In macroeconomic panel regressions, various estimation issues are encountered that must be addressed to make appropriate inferences. The first major hurdle is the omitted variables bias, which can lead to possible correlation between the regressors and the error term. Second, two-way causality between the dependent variable and the explanatory variables is likely to be present, which leads to inconsistent estimators. The third problem specific to dynamic panels is the "dynamics panel bias", from the inevitable correlation between the lagged dependent variable and country-specific fixed effects (Alvarez and Arellano (2003)).

System-GMM is used instead to carry out the estimations (Arellano and Bover (1995) and Blundell and Bond (1998)). While it still might suffer from weak instrument bias, it provides consistent and more efficient estimators. It reduces the bias by incorporating more moment conditions, with these additional moment restrictions also being tested. The regressions are run on first-difference and not on levels, owing to concerns about trending variables and unit root. The test statistics indicate that the instruments are valid[7], and that there is no serial correlation in the error term, which allows us to carry on with the system-GMM method. We can therefore proceed with the following estimation (results are in Table 3.1):

$$\begin{aligned} AssetShortageIndex_{it} &= \beta_1 ASIndex_{it-1} + \beta_2 ln(\Delta GDP_{it}) \\ &+ \beta_3 Inflation_{it} + \beta_4 \Delta RealInterestRate_{it} \\ &+ \beta_5 CountryCreditRating_{it-1} + \beta_6 d.f.Ex.Rate_{it-1} \\ &+ \beta_7 GovtFiscalBalance_{it-1} + \beta_8 Govt.Stability_{it} \\ &+ \beta_9 WorldGDPGrowth_{it} + \beta_{10} X + \varepsilon_{it} \end{aligned} \tag{3.2}$$

with the countries defined in Table 4.10, the key variable and their sources in Table 4.11, 4.12, 4.13, 4.14 and 4.15. The variables were chosen on theo-

[7]We noticed that the Arellano-Bond test statistics are 'too' high in some of the regression specifications, which poses potential problem - invalidity of the instruments, however panel fixed effect estimations are also implemented in parallel as robustness check. The results are similar between two estimation procedures moreover, estimation results on other variables are consistent with the existing literature therefore we believe the results from GMM estimations reflect the true estimates with certain degree of consistency.

retical grounds (see below).

3.5.2 Key Findings

There is strong evidence of asset shortage persistence. An asset shortage in the previous period has a negative impact on asset shortages in the current period, with significance at the 1 percent level. This implies that the imbalance between asset supply and asset demand is not being addressed rapidly by capital markets, which could reflect impediments to asset creation.

Government stability is found to reduce the AS index. Across the various specifications, some statistically significant evidence shows that as government stability improves - presumably leading to a more stable investment climate - investors might be more willing to supply financial assets because uncertainty is diminished. If openness and change in GDP per capita are added as additional variables in the regression, the explanatory power of government stability is reduced - probably because of their co-linear relationship with this variable.

GDP growth worsens the AS index, confirming that economic growth and supply of financial assets do not grow together. The coefficients are significant across all the different specifications, confirming that the issuance of financial assets is not dependent on economic growth per se. A country can therefore grow despite limited financial assets.

A stable macroeconomic environment proxied by low inflation encourages the issuance of financial assets, because it reduces the level of risk, though the statistical significance of this variable is not always strong.

A country's credit rating has no significant power in explaining asset shortages. This means investors are less concerned about a country's credit rating when making investment decisions.

Change in real interest rates is not statistically significant in explaining the AS index, suggesting that interest rates do not act as an equilibrium force between supply and demand for assets in EMs. Under the incomplete market setting that characterizes EMs, this is to be expected, because savings and the supply of financial assets do not necessarily respond rapidly to interest

Table 3.1: System GMM Regression Output for Macroeconomic Variables Explanation of the Index

	Asset Shortage Index								
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A.S. Index (t-1)	0.289***	0.266***	0.262***	0.292***	0.280***	0.283***	0.293***	0.285***	0.288***
	(0.046)	(0.041)	(0.072)	(0.046)	(0.048)	(0.049)	(0.045)	(0.047)	(0.051)
Log ΔGDP	0.0577**	0.063**	0.074	0.058*	0.052*	0.075**	0.068**	0.061**	0.057**
	(0.0282)	(0.028)	(0.048)	(0.028)	(0.026)	(0.028)	(0.029)	(0.028)	(0.027)
Inflation	0.0433	0.048	0.069	0.046	0.045	0.049	0.043	0.047	0.042
	(0.0330)	(0.034)	(0.052)	(0.033)	(0.034)	(0.034)	(0.032)	(0.033)	(0.031)
ΔReal interest rate	-0.00748	-0.012	0.004	-0.003	-0.008	-0.009	-0.004	-0.006	-0.008
	(0.0167)	(0.018)	(0.016)	(0.015)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Countrys credit rating	-0.0976	-0.032	-0.071	-0.103	-0.074	-0.083	-0.063	-0.100	-0.096
(t-1)	(0.0691)	(0.082)	(0.089)	(0.071)	(0.083)	(0.070)	(0.073)	(0.067)	(0.069)
De facto exchange rate	0.0467	-0.006	-0.049	0.047	0.037	0.046	0.041	0.045	0.049
(t-1)	(0.0896)	(0.082)	(0.157)	(0.092)	(0.091)	(0.090)	(0.089)	(0.089)	(0.085)
Government fiscal bal.	1.620*	0.574	1.878	1.690*	1.427	1.657*	1.320	1.849**	1.544*
(t-1)	(0.917)	(1.166)	(1.258)	(0.933)	(0.944)	(0.898)	(0.938)	(0.846)	(0.901)
Government stability	-0.105*	-0.089	-0.130	-0.107*	-0.098*	-0.107*	-0.111*	-0.103*	-0.104*
	(0.0590)	(0.062)	(0.080)	(0.059)	(0.056)	(0.059)	(0.059)	(0.059)	(0.056)
World GDP growth	-4.728*	-4.849*	-4.132	-4.580*	-4.761*	-6.331**	-5.400**	-4.601*	-4.765*
	(2.396)	(2.388)	(2.719)	(2.423)	(2.356)	(2.618)	(2.445)	(2.386)	(2.468)
Openness (t-1)		-0.004*							
		(0.002)							
Log Δ GDP			-0.043						
per capita (t-1)			(0.064)						
Crisis dummy (t-1)				-0.570**					
				(0.215)					
Regional dummy					0.165				
(Latin America)					(0.169)				
Regional dummy					0.032				
(East Asia)					(0.196)				
US nominal interest rate						-0.109***			
						(0.039)			
Corruption (t-1)							-0.120*		
							(0.064)		
Dependency ratio								-0.892	
								(1.107)	
Common law									-0.045
(UK legal origin)									(0.210)
Arellano-Bond test for AR(2)									
In first differences	0.214	0.205	0.469	0.199	0.210	0.142	0.217	0.210	0.213
Hansen test of									
override restrictions	0.986	0.985	0.985	0.982	0.982	0.982	0.981	0.982	0.980

Note: This table shows GMM regression results, instruments are used up to 5 lags.
Robust standard errors in parentheses$***p < 0.01, **p < 0.05, *p < 0.1$

rate signals in these cases, because of information and transaction costs, for instance. The supply of financial assets is inelastic to interest rates and dependent on other factors.

The exchange rate regime is insignificant in explaining the AS index. The impact of a stable exchange rate is theoretically ambiguous. We could have expected that a stable exchange rate policy, by reducing exchange rate risk, would make issuance of financial assets in overseas markets more attractive. At the same time, domestic savers might prefer to park their savings overseas to diversify away from risk, thereby reducing domestic asset shortages.

Government fiscal balance has a positive impact on the AS index. As expected, countries in better fiscal positions have lower AS indexes. Although a small budget deficit - the raw material for securitized government debt - is needed to create a benchmark on how to price other financial assets and thereby encourages the supply of financial assets, large deficits have an inverse impact on the AS index by creating instability. However, it is not significant across all specifications of the regressions, presumably because the explanatory variable is highly co-linear.

World growth appears to have a small, but statistically significant impact on reducing asset shortages. The coefficients on world GDP growth are all negative and significant at 10 or 5 percentage levels. Why this finding? First, domestic exporting companies will increase their investment level, hence issuing more financial assets. In addition, higher world growth makes foreign assets more attractive to domestic investors, leading to an outflow of savings overseas.

Openness, as measured by world trade, has a negative, though weakly significant, impact on the AS index. Globalization has in most cases proceeded gradually, liberalizing trade before liberalizing the capital account. As the domestic economy becomes more integrated into the world economy, an EM can improve its welfare by specializing in products in which it has a comparative advantage, thereby increasing its income. Initially, if the capital account is still closed, the domestic firm will issue more financial assets domestically, thereby reducing the AS index.

GDP per capita is insignificant in explaining the AS index. This means

that asset shortage is not explained by the level of economic development and can affect rich Gulf countries as much as Latin American countries.

The coefficient of the crisis dummy is negative and significant at the 1 percent level. This reflects the fact that, during a crisis, savings fall more rapidly than does the issuance of financial assets and is consistent with the view that savings collapse during a crisis, thereby reducing the asset shortage imbalance.

Corruption[8] has a negative coefficient and is statistically significant, though only at the 10 percent level. By increasing uncertainty, and hence the cost of doing business, asset issuance becomes less likely. Therefore, the more corrupt countries have bigger asset shortage problems.

US interest rates have a negative and significant explanatory power in the AS index. As overseas asset returns increase, they become, relatively speaking, more attractive to domestic investors. The resulting large capital outflow effectively reduces domestic asset shortages.

The dependency ratio - the ratio of individuals under 15 or over 65 relative to the working population - does not have a statistically significant impact on asset shortages. We would expect that as the dependency ratio falls in EMs, rising incomes and savings should initially out pace the supply of financial assets. However, as our group of EMs is heterogeneous, cultural and institutional differences could explain the variation in the saving rates, independent of the dependency ratio. Also, income, regardless of the dependency ratio, might be unequally distributed in many EMs.

Regional variations do not appear to explain the AS index. Both the Latin America and East Asia regional dummies are statistically insignificant in explaining asset shortages, implying that regional differences are not important in explain differences in asset shortages across countries.

If we analyze institutional differences, as proxied by the difference between common law jurisdictions (as proxied by UK legal origin) from civil law ones, we do not have a statistically significant effect either. Although La Porta, Lopez-de Silanes, Shleifer, and Vishny (1997) suggest that common law is associated with more dynamic economies, because it protects creditors more

[8]Note: A higher number corresponds to a country with lower corruption level.

strongly, we find this effect does not matter for asset shortages. This means that imbalances in savings and financial assets are not affected by institutional differences.

3.5.3 Regulation

As argued above, regulations are another important determinant of asset shortages. So far, our analysis has focused primarily on macroeconomic variables, but institutional factors also affect asset shortages. In what follows we will study the impact on asset shortages of regulations imposed by national authorities. In EMs, the regulatory environment is often very stringent, which could be a reason for the large AS index. Econometrically, using system-GMM is complicated by the fact that most regulatory variables are dummy variables or variables that contain limited variance, making it difficult to obtain a set of valid instruments. Furthermore, when regulations are implemented, asset shortages are typically not a major consideration, such that reverse causality (from asset shortages to regulation variables or when these indicators were constructed they did not take asset shortage into consideration) is likely to be weak. The random effects can yield a more efficient estimator; however, random effects do not always guarantee a consistent estimator. Therefore the Hausman test (not reported) to investigate the consistency of the RE estimator is used; as it cannot be rejected, the more efficient RE will be employed (for completeness, both FE and RE are illustrated).

We estimate the following regression:

$$\begin{aligned} ASIndex_{it} &= \beta_1 CapitalAccountOpenness_{it-1} + \beta_2 BusinessFreedom_{it-1} \\ &+ \beta_3 FinancialFreedom_{it-1} + \beta_4 PropertyRights_{it-1} \\ &+ \beta_5 X + \varepsilon_{it} \end{aligned} \tag{3.3}$$

Capital account openness (K.A. openness), business freedom, financial freedom, and property rights, and other variables are added to the regression individually. Note that the R-squared measure of goodness of fit is quite low (see Table 3.2). This is not unexpected, as we are using regulation variables on the right hand side, which, because of lack of granularity, have low variability.

The coefficients of capital account openness are negative and significant. Capital account openness is a variable constructed by Chinn and Ito (2008)

Table 3.2: Fixed Effect/Random Effect Estimations for the Asset Shortage Index

	Asset Shortage Index							
	(1)	(1)	(2)	(2)	(3)	(3)	(4)	(4)
Independent variables	FE	RE	FE	RE	FE	RE	FE	RE
K.A. openness (t-1)	-0.184*	-0.213***	-0.188*	-0.200**	-0.189*	-0.221***	-0.207*	-0.223***
	(0.103)	(0.082)	(0.109)	(0.087)	(0.108)	(0.084)	(0.107)	(0.084)
Business freedom (t-1)	-0.027**	-0.033***	-0.028**	-0.033***	-0.029**	-0.034***	-0.030**	-0.034***
	(0.013)	(0.011)	(0.013)	(0.011)	(0.013)	(0.011)	(0.013)	(0.011)
Financial freedom (t-1)	-0.004	-0.006	-0.003	-0.004	-0.003	-0.005	-0.004	-0.005
	(0.008)	(0.007)	(0.009)	(0.007)	(0.009)	(0.007)	(0.009)	(0.007)
Property rights (t-1)	0.026***	0.020***	0.024**	0.018**	0.025***	0.019***	0.021**	0.018**
	(0.009)	(0.007)	(0.010)	(0.008)	(0.009)	(0.007)	(0.010)	(0.008)
Economics risk (t-1)			-0.009	-0.021				
			(0.027)	(0.024)				
Government stability (t-1)					0.026	-0.008		
					(0.067)	(0.062)		
Law and order (t-1)							0.253	0.082
							(0.160)	(0.119)
Constant	0.927	1.693**	1.315	2.441**	0.771	1.814**	0.370	1.499*
	(0.879)	(0.692)	(1.396)	(1.096)	(1.028)	(0.859)	(0.972)	(0.772)
Observations	442	442	432	432	432	432	432	432
R-squared (overall)	0.048	0.070	0.055	0.076	0.049	0.073	0.035	0.067
Number of id	37	37	37	37	37	37	37	37

Robust standard errors in parentheses $***p < 0.01, **p < 0.05, *p < 0.1$

and is an index that measures the extent of restrictions on external accounts, with a higher value reflecting more open cross-border capital transactions. This result suggests that by widening the investment universe for domestic institutional investors in EMs, and allowing savings to be invested overseas, the domestic AS problem is reduced.

The business freedom index is statistically significant and negative, suggesting that a friendlier business environment reduces the AS index. The business freedom score is composed of various factors with equal weights: procedures, time, cost, and minimum capital for starting a business, obtaining a license and the time, cost recovery rate for closing a business. The business freedom index ranges from 0 to 100; a higher value implies a more friendly business environment. As the business environment improves, investors will find it easier to create new businesses and invest, thereby increasing the supply of financial assets and decreasing the asset shortage.

The financial freedom index, stronger property rights, and macroeconomic risks (Government stability) have no significant impact on reducing the asset shortages. The financial freedom index is a measure of government intervention in the financial markets, with higher values representing fewer regulations imposed by the government. Our finding shows that countries with stronger government intervention in capital markets do not have larger asset shortages than less interventionist countries. Stronger property rights are not found to lead to greater issuance of financial assets. Intuitively, it would be expected that stronger property rights, by increasing protection, should be good for asset issuance. As EMs are still catching up, and therefore use existing technologies to grow, stronger property rights may in fact be bad for growth by hindering the copying of existing technologies, and hence increasing asset shortages. Only when countries have reached sufficiently advanced development will property rights be good for asset issuance (Chang (2001)).

Economic risk - a measure of the overall macroeconomic environment - is shown to have insignificant effects on the AS index. The index is a composite of GDP, growth, inflation, balanced budget, and current accounts. This suggests that improving economic stability does not matter for our countries, perhaps because the countries in our sample are stable enough to generate financial assets.

Law and order has a positive but insignificant impact on asset shortages. This suggests that a stronger legal system, which protects investors more solidly, will not lead to the issuance of more financial assets relative to national savings.

We can conclude that the ease of doing business, rather than economic stability, matters the most in reducing asset shortages. However, macroeconomic factors, as well as regulation variables, also affect asset shortages.

Remark, one caveat applies when reading these results against the prediction in Chapter 2. The theory suggested in Chapter 2 predicts the business freedom (instead of the financial freedom index) to be negatively correlated with the asset shortage index, if it has any predictive power. The reason been that by construction the business freedom index captures the idea of minimum percentage of capital (as share of income per capita) required to start-up a business, where a lower percentage represents a more friendly business environment reflected as a higher business freedom score. Therefore, when the asymmetric financial market arises as discussed in Chapter 2, it translates into a higher minimum percentage of capital required to start-up (a lower business freedom score), hence it worsen the asset shortage index. Where as the financial market freedom index measures the degree in which government's control on financial market, one reason that it is insignificant in explaining asset shortages, may due to the government's 'control' became more 'invisible' over time in the EMs.

3.6 Conclusion and Policy Implications

In this chapter, an index to proxy the asset shortages in EMs by capturing the difference between the demand and supply of financial assets was constructed. This allowed the analysis of the evolution of asset shortages over time. To our knowledge, this is the first such measure to have been constructed. This index provides a quantitative measure to study asset shortages. To reduce the imbalances between supply and demand for financial assets in EMs, but even more so to frontier markets - the subset of emerging markets with small and illiquid market capitalizations - several policy measures could help:

3.6.1 Capital Market Development

To spur the supply of financial assets, developing the capital market further is crucial. Improving the efficiency of capital markets helps increase access to financing for the private sector, lowering the cost of financing, distributing risk, and supporting long-term growth. For example, Peru, Chile, and Colombia have implemented measures to integrate their stock exchanges, potentially overtaking Mexico as Latin America's second largest market. This will facilitate cross-border transactions in stocks and increase trading volume as the greater size and diversity of an integrated stock exchange will lure more investors, such as local pension funds for whom cross-border investments could then be considered a local rather than foreign asset.

Similarly, many countries have developed alternative markets for mid-cap companies in the early stages of development. Inspired by the success of AIM in London, some EMs have with varying degree of success managed to such markets. Key requirements for this to work though are an investor base willing to take risk and the existence of companies with potential.

3.6.2 Improving Regulation to Increase Supply

The authorities should clarify legislation and modify regulations to spur the supply of new financial assets. Regulatory restrictions on the investment of pension funds in Latin American countries in nontraditional instruments (private equity, real estate, lower-rated fixed income products, etc.) and illiquid assets in the stock market have limited the opportunities for growth. Liberalizing these investment restrictions, by widening the investment universe, could increase investment opportunities for EM investors, especially institutional ones. In most EMs, the market for covered mortgage loans is underdeveloped, given vague legal and regulatory frameworks on the treatment of covered bonds in cases of bankruptcy, collateral and matching requirements, and valuation issues. Addressing these issues could pave the way for the growth of covered bond markets in many EMs. Similar reforms may be needed to create an asset backed securities (ABS) market for mortgages.

Governments should develop comprehensive policies to support new companies by fostering private equity and venture capital industries. This can take the form of tax incentives to invest in high risk asset classes, or complementing private investment by public sector co-investment in some ventures

targeting earlier stages of development. Brazil and South Africa are successful examples of such policies. Asymmetric financial markets need to be removed, policy which discriminates a certain set of firms from the credit market should be eliminated. Moreover policymaker should take extra caution when designing the policies, in order to minimizes the 'unintended' consequences which create distortion in the financial markets and lead to asset shortages[9].

Rules should be set in place to increase the supply of assets further by enforcing a minimum amount of assets that must be listed on a stock exchange. For example, in 2010, the Ministry of Finance in India announced new rules for companies listed on Indian bourses, requiring them to make available, within 5 years, a minimum of 25 percent of equity, as opposed to the existing 10 percent. This should raise liquidity, and thereby reduce volatility[10].

Countries with many state-owned Enterprises (SOEs) could also launch a program to list and privatize. Malaysia is currently launching such an exercise. While privatization per se is not a panacea in necessarily improving the productivity of SOEs, it does tend to improve governance and profitability of companies, and has the side benefit of increasing the supply of financial assets.

Regulators should remove or reduce the limit on how much institutional investors are allowed by law to invest overseas. This would allow the system to mitigate the excessive exposure to domestic systemic risk and the risk of domestic security prices moving too far from fundamentals. Local market booms tend not to persist indefinitely, and there is a need to protect retirement savings from the swings that characterize most small and open economies. Local markets are poorly correlated with international markets, and thus diversification is likely to pay off in the long term. Furthermore, for crisis-prone economies, domestic systemic risk makes it advisable to partially rely on more stable markets. Finally, it is not necessary for the pension fund manager to deal with foreign asset selection directly, because many reputable international global fund managers with excellent track records can be hired at low cost.

[9]See Chapter 2 for a detailed discussion.

[10]Development of hedging instruments is also important. In this regard, the surge in the use of derivates to hedge currency and interest rate risk bodes well for more complete capital markets. Korea, Hong Kong, and Singapore have a well-developed interest rate, futures, and currency swap market, respectively, while in countries with capital account restrictions (e.g., China and India), use of the non-deliverable forward market is widespread.

The business environment should be improved. Encouraging entrepreneurs to expand by using capital markets is an important step in increasing asset supply.

3.6.3 Reducing Savings

Too often, going public, which raises the company's visibility, leads to regulatory hurdles and increased costs, thereby discouraging asset issuance. One reason EMs have large savings rates is as a precautionary tool. Increasing consumption can therefore also help EMs reduce asset shortages. This can be achieved by strengthening social safety nets. High saving rates in EMs (e.g., China) have been described as a reflection of high individual risk, related to costs of health, retirement, and education. Therefore it is important to improve the ability of individuals to insure against these types of risks. For example, in 2008 China expanded the "Yi Bao" (a Chinese state health care system) to 229 cities.

In countries where the fiscal position is very strong and infrastructural needs are acute, raising infrastructural investment can be a way of reducing national savings while creating positive externalities for the rest of the economy. Following past crises, governments in EMs have been reluctant to spend money, even if the social rate of return is very high, for fear of over-indebting themselves. However, the positive externalities of government spending on growth, such as infrastructure for example, could be even more important if it leads to the supply of financial assets that could spur further development of capital markets.

While there is no magic bullet, a comprehensive set of reforms mentioned above will certainly help reduce the asset shortage problem, and will stimulate the development of EMs further. It will improve the macroeconomic environment of EMs, by spurring growth, leading to a better allocation of resources, and reducing the likelihood of bubbles.

3.A Appendix

3.A.1 Tables

Table 3.3: Regulatory Restrictions on Pension Funds in Brazil (as of April 2010, as a percentage of assets under management)

Brazil	
Assets	Maximum Limit
Government	100
Corporate Debt	80
Equities	50
Real Estate Investment	8
Loans and Financing	15
Offshore Investment	3

Corporate Debt applies for high quality assets
Source: SPC and J.P. Morgan

Table 3.4: Regulatory Restrictions on Pension Funds in Colombia (as of April 2010, as a percentage of assets under management)

Colombia	
Assets	Maximum Limit
Government (Domestic and External)	50
Corporate Bonds	40
Fogafin/Fogacoop	10
Mortgage Security	40
Equity/Soc. Participations	40
Offshore Issued Assets (EQ+FI)	5
CDs	5

Source: Superfinanciera and J.P. Morgan

Table 3.5: Regulatory Restrictions on Pension Funds in Uruguay (as of April 2010, as a percentage of assets under management)

Uruguay	
Assets	Maximum Limit
Sovereign Debt	60
CB + Hipotecario Bank	30
Onshore Deposits	30
Hedge Operations	10
Offshore Fixed Income Assets	15

Source: J.P. Morgan

Table 3.6: Regulatory Restrictions on Pension Funds in Peru (as of April 2010, as a percentage of assets under management)

Peru			
Assets	Maximum Limit		
Overall Investment Limits			
Sovereign Debt (A)	30		
CB Instruments (B)	30		
Sovereign and CB instruments (A)+(B)	40		
Offshore holdings	30		
Maximum Limits by funds	Fund 1	Fund 2	Fund 3
Local and Offshore Equities	10	45	80
Bonds	100	75	70
Short-term Securities and Cash	40	30	30
Derivatives	10	10	20

Source: SBS and J.P. Morgan

Table 3.7: Regulatory Restrictions on Pension Funds in Chile (as of April 2010, as a percentage of assets under management)

Chile					
Assets	Fund A	Fund B	Fund C	Fund D	Fund E
Government Debt	60	60	60	60	60
Corporate Bonds (pri.+pub)	30	30	10	10	3
Foreign Currency Investments(*)	50	40	35	25	15
Equities	80	60	40	20	5
CDs (Offshore)	15	15	15	15	15
Mutual Funds+Invet. Funds	40	30	20	10	5
Overnight Deposits	2	2	2	2	2
Onshore Mutual Funds	5	5	5	5	5

Net of hedge positions: an overall limit of 30 percent of AUM (unhedged) applies for the entire portfolio.
The 15 percent limit applies to the onshore portfolio.
Source: SAF JP and J.P. Morgan

Table 3.8: Regulatory Restrictions on Pension Funds in Mexico (as of April 2010, as a percentage of assets under management)

Mexico					
Assets	Fund 1	Fund 2	Fund 3	Fund 4	Fund 5
Equities (domestic+Foreign	0	15	20	25	30
Foreign Currency Investment	30	30	30	30	30
Government Securities	no limit	no limit	no limit	no limit	no limit
International Fixed Income	20	20	20	20	20
Corporate Debt	no limit	no limit	no limit	no limit	no limit
Financial Institutions	no limit	no limit	no limit	no limit	no limit
Mortgage-backed Securities	no limit	no limit	no limit	no limit	no limit
Semi-stat, state and Municipal entities	no limit	no limit	no limit	no limit	no limit
VaR (currently not published)	no limit	no limit	no limit	no limit	no limit

Source: Development Banks, non-bank banks, commercial banks and other financial services.

3.A.2 Figures

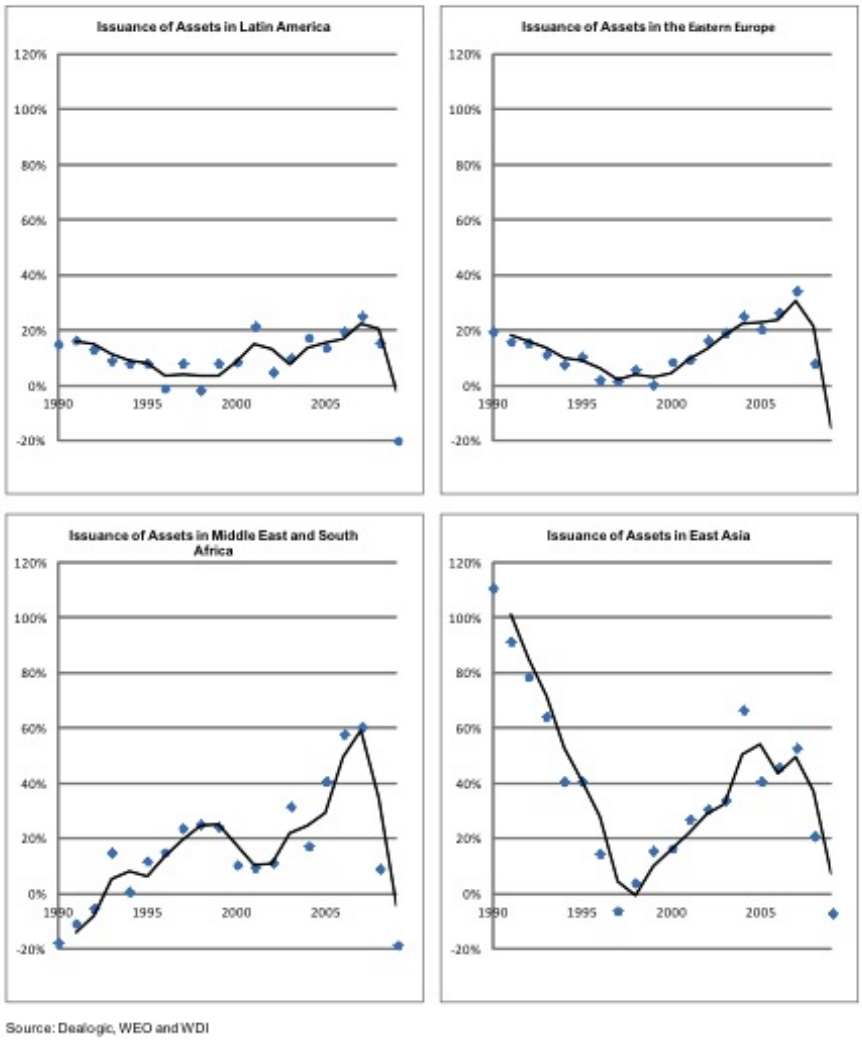


Figure 3.4: Asset Issuance by Region between 1990 and 2008 (share of GDP). Top-left: Latin America. Top-right: Eastern Europe. Bottom-left: Middle East and South Africa. Bottom-right: East Asia.

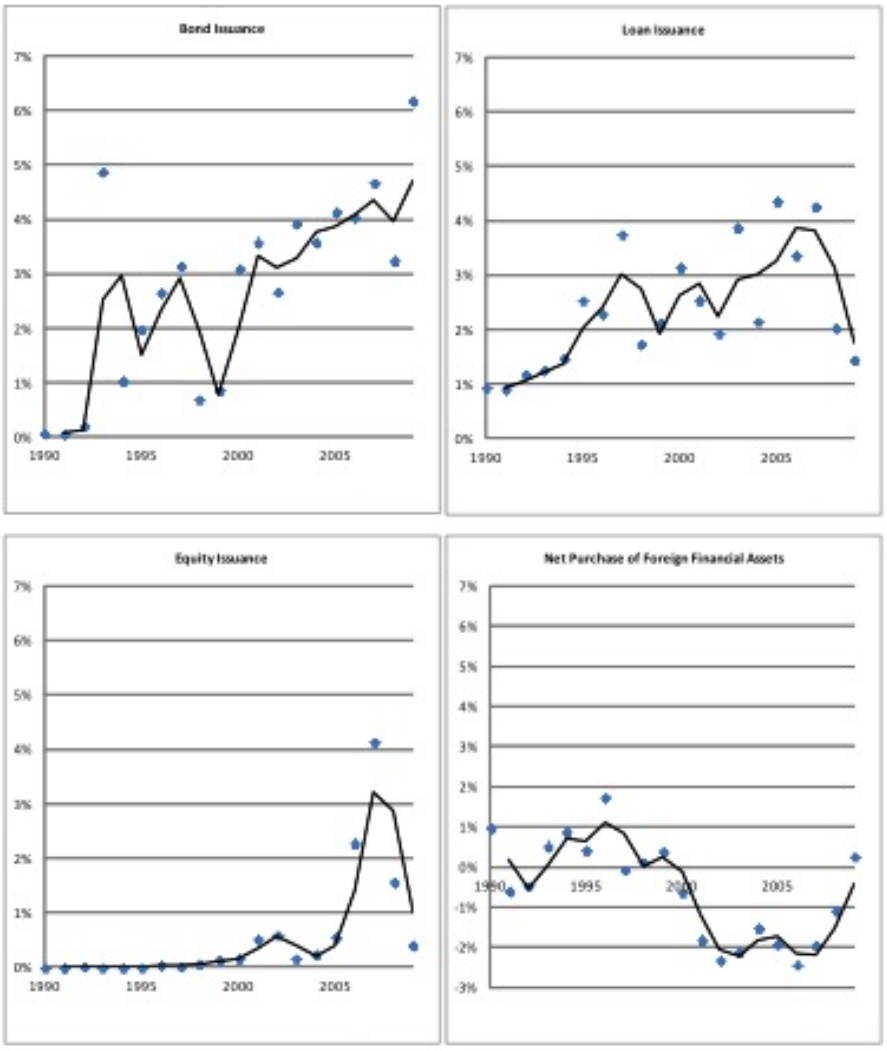


Figure 3.5: Issuance of Financial Assets in Emerging Markets between 1990 and 2008 (share of GDP). Top-left: Bond. Top-right: Syndicated Loan. Bottom-left: Equity. Bottom-right: Net Purchase of Foreign Assets.

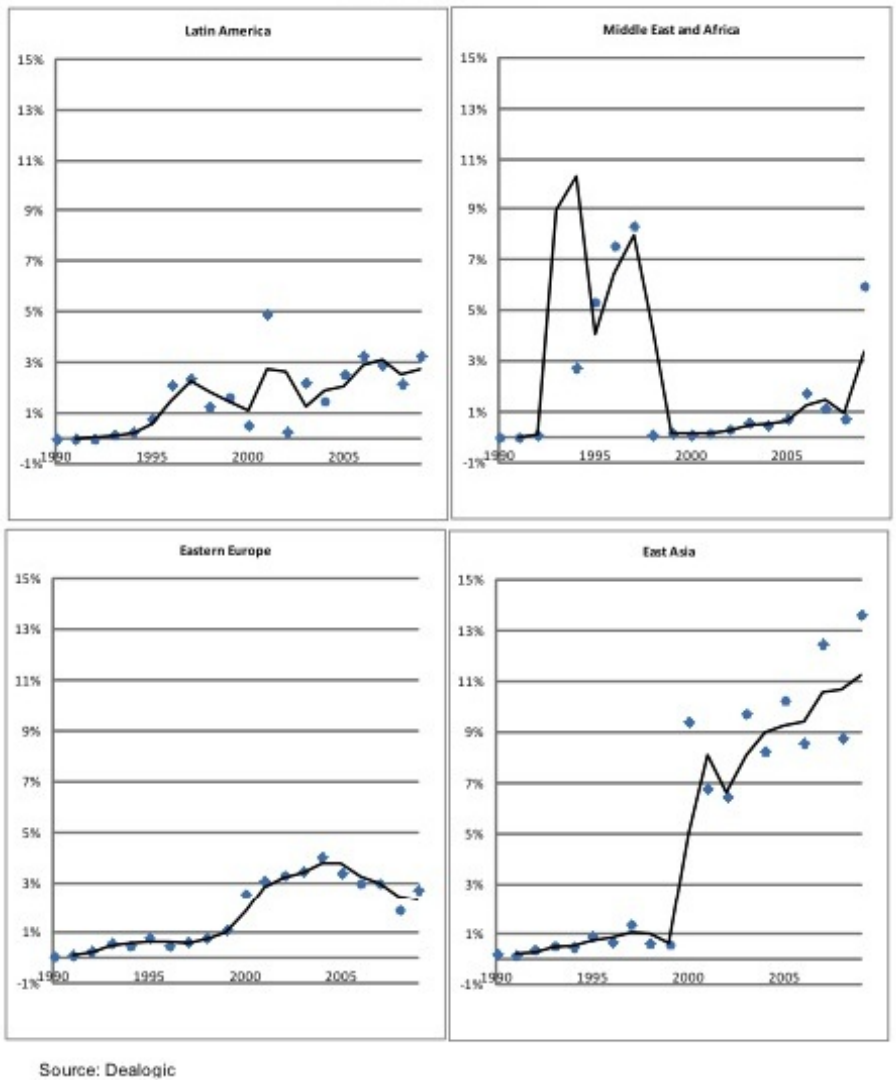


Figure 3.6: Bond Issuance by Region between 1990 and 2008 (share of GDP). Top-left: Latin America. Top-right: Middle East and Africa. Bottom-left: Eastern Europe. Bottom-right: East Asia.

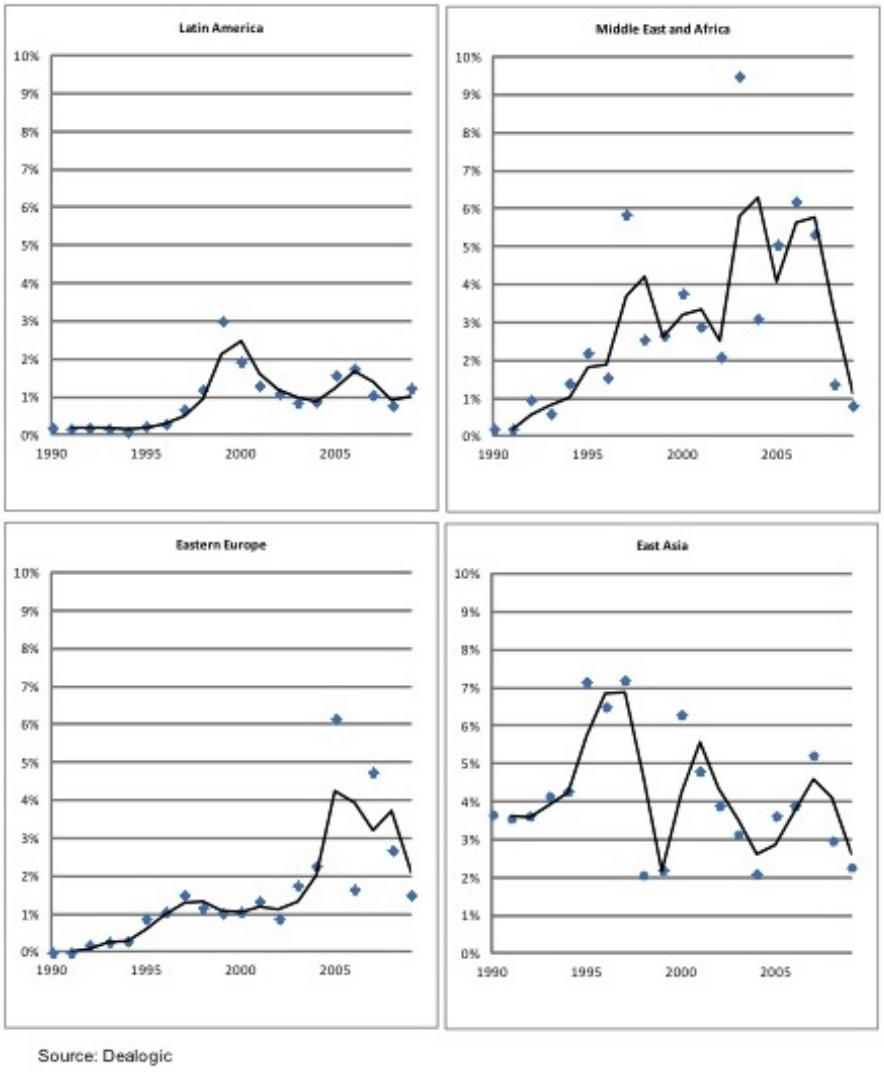


Figure 3.7: Syndicated Loan Issuance by Region between 1990 and 2008 (share of GDP). Top-left: Latin America. Top-right: Middle East and Africa. Bottom-left: Eastern Europe. Bottom-right: East Asia.

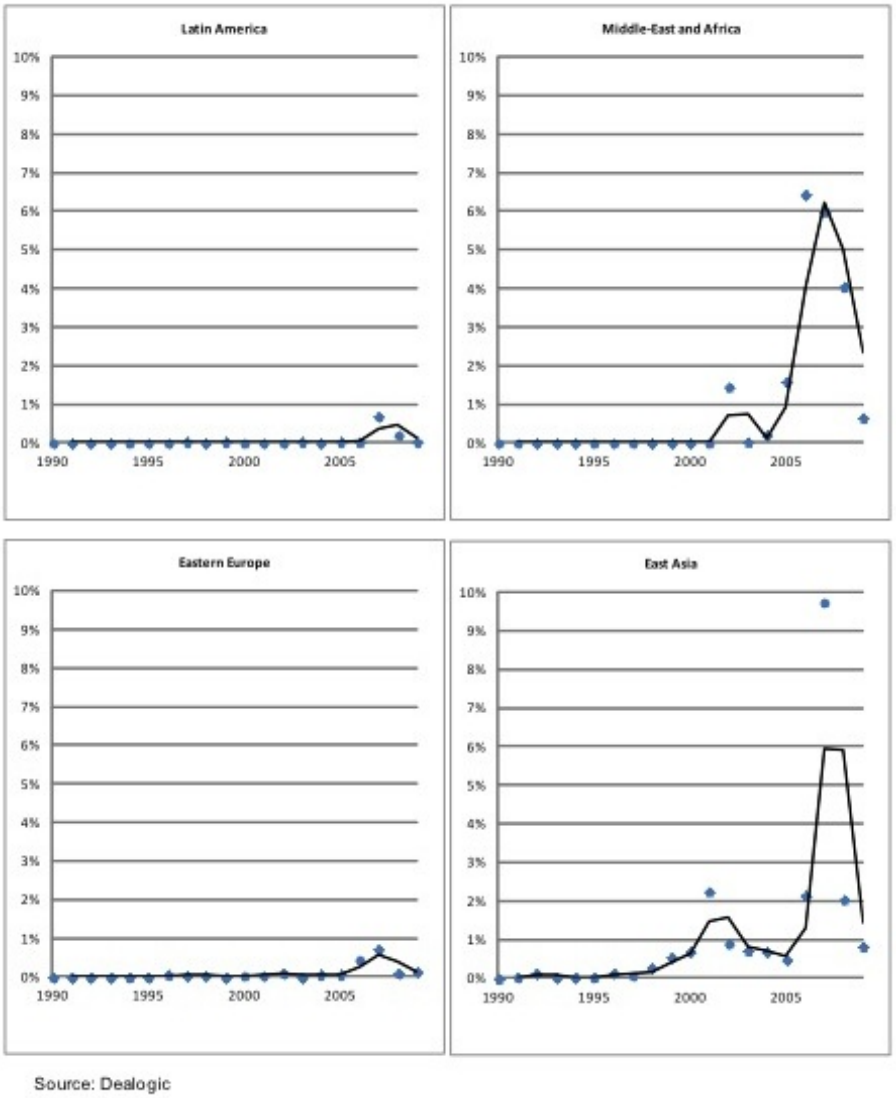


Figure 3.8: Equity Issuance by Region between 1990 and 2008 (share of GDP). Top-left: Latin America. Top-right: Middle East and Africa. Bottom-left: Eastern Europe. Bottom-right: East Asia.

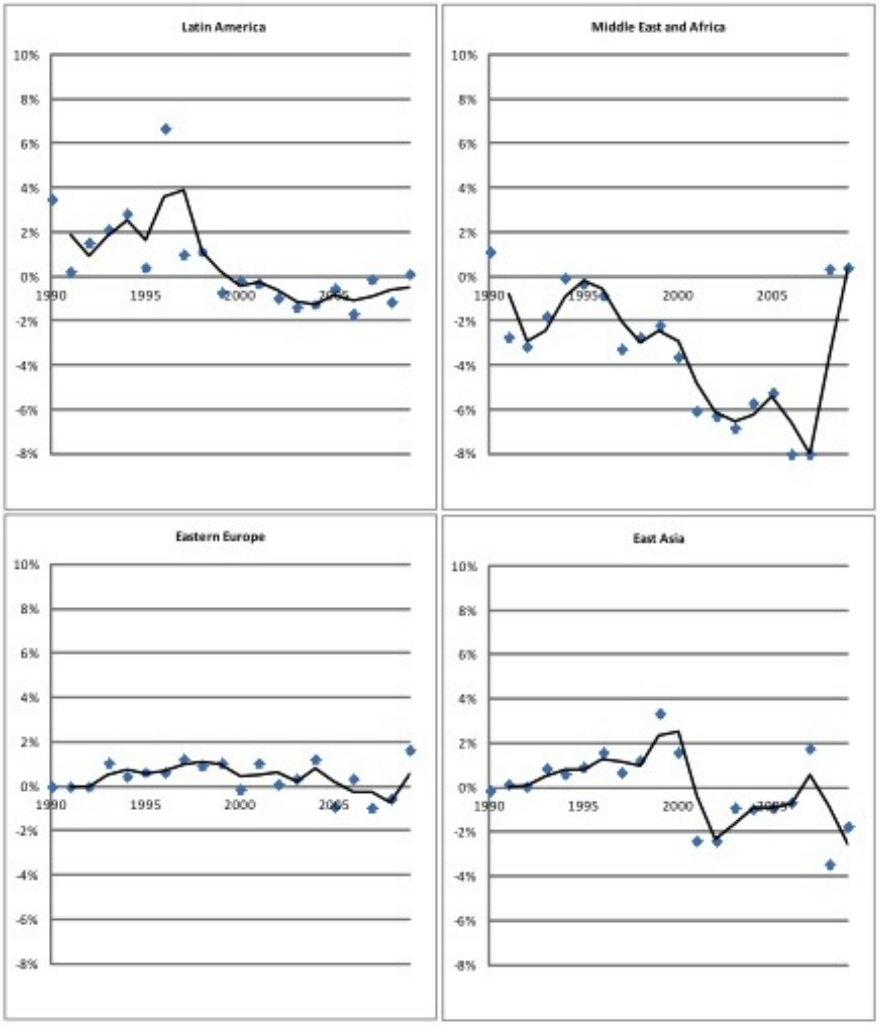


Figure 3.9: Net Purchase of Foreign Assets between 1990 and 2008 (share of GDP). Top-left: Latin America. Top-right: Middle East and Africa. Bottom-left: Eastern Europe. Bottom-right: East Asia.

Chapter 4

Consequences of Asset Shortages in Emerging Markets

4.1 Introduction

Emerging market economies (EMs) have weathered the global crisis since 2008 relatively well. Underlying the resilience were strong macroeconomic fundamentals, the solid balance sheets of governments (low public debt), corporates, and the private sector, and a tightly regulated banking system. The rapid rebound in most EMs attests not only to the strong fundamentals, but also to the skillful policy management of most authorities in these countries.

Yet, as illustrated in Chapter 3, despite solid fundamentals and enormous wealth creation, EMs have not been able to generate enough financial assets to invest their rising savings. This asset shortage is not limited to safe assets (see Caballero (2006)) but encompasses riskier types of assets as well, ranging from both fixed income to equity instruments. This is in part because capital markets in EMs tend to be relatively shallow. They are less complex than their counterparts in advanced economies, with banks typically playing a larger role than non-bank financial institutions. Liquidity in these markets is often eroded by sudden shocks, causing panic sales and disorderly adjustment. In addition, the domestic investor base is not diverse enough to act as a source of stability during a crisis. Such an underdeveloped infrastructure is not conducive to the supply of financial assets.

This chapter proposes a theoretical model of the impact of asset shortages on the macroeconomic environment, and after calibrating the model, also to

test it econometrically. This chapter aims to demonstrate that if the supply-demand imbalance of domestically investable financial assets is not addressed, it could potentially result in large macroeconomic imbalances that threaten financial and macroeconomic stability. It will be shown that a shortage of investable assets leads to suboptimal growth, as savings cannot be channeled optimally to investment projects. In addition, asset shortages, combined with restrictions on investment abroad, lead to excess liquidity that lowers interest rates and raises asset prices on equity, bonds, and housing. The outcome of too much capital chasing too few assets is bubbles followed by a crisis. Market efficiency is also affected, as in a world of imperfect capital mobility - owing to investment restrictions misalignments in asset valuation relative to the economic fundamentals can be long lasting. Finally, the current account is impacted by asset shortages, with economic agents attempting to shift their savings overseas, creating structural surpluses.

The chapter is structured as follows. In Section II, we provide the theoretical model and calibrate it; in Section III, we empirically estimate the consequences of asset shortages. Section IV concludes with policy implications.

4.2 Theoretical Model

In this section, we develop a small open economy model based on Chen (2011) to illustrate how asset shortages in EMs lead to lower economic growth, an increase in local asset prices, and current account surpluses. The starting point is to divide the world into two regions: Emerging Markets (EM) and Advanced Economies (AE), with the focus being on the former group. The key feature of the model is that it focuses on region EM's inability to supply financial assets to domestic savers. The inability to generate sufficient instruments locally, from safe triple A-rated store-of-value instruments to riskier bonds and equity, increases EM savers' demand for overseas investable instruments. If distortions, such as regulations, restrict the outflow, the excess demand for investable assets will spill over into the domestic economy. EMs' inability to create a large set of financial assets will (i) starve domestic firms of capital, thus slowing their growth, (ii) push up domestic asset prices, and (iii) create a current account surplus.

4.2.1 The Basic Structure - A Small Open Economy

The benchmark framework consists of multiple open economies, characterized by an overlapping generation structure. This structure provides scope for both international and intergenerational borrowings. In each region, a final good producer manufactures one type of tradable final good (Y_{EM},Y_{AE}), with each final good produced with intermediate goods that are not traded across borders. Households own the intermediate good producing firms. In this world, borrowing ability matters prior to production; each potential new firm needs to make a fixed investment, which is financed by borrowing against the present discounted value of future cash flows. The fraction of the present value of future profits that a potential entrant can pledge is the borrowing constraint. Furthermore, the weighted average of all agents' borrowing ability within each region (EM, AE) is defined as the financial development in that region. The inability to supply financial assets is therefore akin to a tightening of borrowing abilities.

4.2.2 Consumption

Time is evolving continuously, with infinitesimal agents born at a rate ρ per unit time and dying at the same rate, leading to a constant population mass equal to one. Consider an agent in region EM, who optimally decides the consumption of the final good and savings, where he can purchase the local assets or/and the assets issued by the intermediate firms (more on this below). Following Blanchard (1985), we 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. If an agent's wealth is ω, they will receive $\rho\omega$ if they do not die, and pay ω if they die. By assuming agents have logarithmic utility functions, optimal aggregate consumption and saving (wealth) dynamics have the following characteristics:

$$\begin{aligned} \dot{C}_t &= (r_t - \tau)C_t - \rho(\rho + \tau)W_t \\ \dot{W}_t &= r_t W_t + A_t - C_t \end{aligned} \tag{4.1}$$

where, A_t denotes aggregate (across all household) income at time t, W_t is the total wealth (saving) at time t, C_t is the aggregate consumption, while r_t is the exogenous foreign interest rate and τ is the (domestic) time discounting factor.

The final goods produced in each region EM and AE, are traded across borders. Therefore, the optimal intra-temporal consumption decision for an agent in region EM or AE is:

$$c_{i,t}^{j} = \Big(\frac{P_{i,t}^{j}}{P_{t}^{j}}\Big)^{-\theta} C_{t}^{j} \qquad i,j = EM, AE \tag{4.2}$$

where, $c_{i,t}^{j}$ is the consumption for final good i at time t in region j, $P_{i,t}^{j}$ is the price of good i at time t, θ is the elasticity of substitution between goods and $P_{t}^{EM} = P_{t}^{AE} = ((1/2p_{EM,t}^{1-\theta} + 1/2p_{AE,t}^{1-\theta})^{\frac{1}{1-\theta}}$ is the price index of the consumption bundle C_{t}^{j} in region EM and AE, which we normalize to 1. Since households in each region consume the same basket of final goods, $P_{t}^{EM} = P_{t}^{AE}$.

4.2.3 Production

Let us begin by focusing on the EM region. The final good producer's production technology uses 0 to w_{EM} intermediate goods as inputs to produce one unit of final good Y_{EM}:

$$Y_{EM} = w_{EM}\Big(\int_{0}^{1} (y_{EM}(i))^{\frac{\theta-1}{\theta}} di\Big)^{\frac{\theta}{\theta-1}} \tag{4.3}$$

where, Y_{EM} denotes the final good produced in region EM, w_{EM} refers to the number of intermediate good producing firms in the region, and $y_{EM}(i)$ is the intermediate good with i input for production. The same applies for the final good produced in region AE.

The final good producer chooses the quantity of intermediate inputs $y_{EM}(i)$ to minimize the total cost function subject to a given level of output $\bar{Y}_{EM}$:

$$min_{y_{EM}(i)}\Big(w_{EM}p_{EM}(i)y_{EM}(i)\Big) \tag{4.4}$$

subject to

$$Y_{EM} = \bar{Y}_{EM} \tag{4.5}$$

gives:

$$y_{EM}^{*}(i) = \frac{1}{w_{EM}}\Big(\frac{P_{EM}(i)}{P_{EM}}\Big)^{-\theta} \bar{Y}_{EM} \tag{4.6}$$

Intermediate good producing firms use only labor as the factor of input. Under monopolistic competition, they set the prices at a constant mark-up

over the marginal costs: $p_{EM}(i) = (\frac{\theta}{\theta-1})(\frac{v}{\varphi(i)})$, where v is the wage rate determined by labor market clearing condition[1], $\varphi(i)$ is firm i's specific productivity parameter. Intermediate firms take the demand as given from the final good producer, generating a profit function at time t that has the following form:

$$\pi^*_{EM,t}(i) = \Big(\frac{v^{1-\theta}}{\theta-1}\Big(\frac{\theta}{\theta-1}\Big)^{-\theta}\Big)\frac{\varphi^{\theta-1}_{EM}(i)}{w_{EM,t}}\Big(\frac{P_{EM,t}(i)}{P_{EM,t}}\Big)^{-\theta}\bar{Y}_{EM,t} \tag{4.7}$$

4.2.4 Intermediate Firm Entry and Exit Decisions

• Entry.

There is a large (unbounded) pool of prospective entrants into intermediate good production. We assume that each firm is owned by an agent; initially a firm (or agent) draws a productivity parameter φ from a common distribution $g(\varphi)$. $g(\varphi)$ has positive support over $[\varphi_{min}, \infty)$ and has corresponding cumulative distribution $G(\varphi)$. To enter, each potential entrant has to make an initial sunk investment in the form of a fixed entry cost $F_{EM} > 0$. To finance this initial fixed cost, each firm needs to borrow against its present discounted value of future profits. Therefore, each potential entrant, given his productivity parameter, knows the entry cost and the fraction he can borrow, and all firms simultaneously decide whether to begin production or not.

In summary, a potential entrant will enter intermediate good production if and only if he makes non-negative profit by entering and meets the initial financial requirement. Consider an agent with borrowing ability δ, meaning he can pledge δ fraction of discount value of future profits. In that case, the entry decision rule is given by :

$$\delta_{EM}\pi_\infty(i) - F_{EM} \geq 0 \tag{4.8}$$

where $\pi_\infty(i)$ denotes the present discounted value of future profits for a potential intermediate firm i.

$$\pi_\infty(i) = \int_t^\infty \pi_s(i)e^{-\int_t^s (r(\tau)+\rho)d\tau}ds \tag{4.9}$$

Furthermore, let Π_t denote the aggregate (across all intermediate firms) profit

[1]We assume that labour market is operating at its natural level of employment, moreover, labour can not switch between jobs due to reasons such as skill mismatch. In contrast to Chen (2011) we make this inflexible labour market condition assumption to generate a fallen output after the asset supply shock.

at time t.

$$\Pi_t = w_{EM} \int_0^1 \pi_s(i) di \tag{4.10}$$

The reservation productivity φ^*_{EM} is characterized by the following equation, implying that all potential entrants with productivity draw higher than φ^*_{EM} will enter and begin intermediate goods production.

$$\varphi^*_{EM,t} = \Big(\frac{\delta_{EM}}{F_{EM}}\Big(\frac{1}{\theta-1}\Big)^{1-\theta} \int_t^\infty (v_s)^{1-\theta} \omega^{-1}_{EM,s} (C_{EM,s}+C_{AM,s}) e^{-\int_t^s (r(\tau)+\rho)d\tau} ds\Big)^{\frac{1}{1-\theta}} \tag{4.11}$$

The Nash Equilibrium number of firms in the market is then given by:

$$w_{EM,t} = 1 - G(\varphi^*_{EM,t}) \tag{4.12}$$

- Exit.

Following Chen (2011) we assume, that after a firm successfully entered the intermediate good production, it has to pay a running cost $f_{EM,t}$ (to its current owner/agent) each period, which is financed by firm's current period profit. For example, this cost can be seem as the additional compensation to the managers. Therefore, intermediate firm can only continues to produce if and only if:

$$\pi_{EM,t}(i) - f_{EM,t} \geq 0 \tag{4.13}$$

Otherwise, firm exists the production at time t. I discuss $f_{EM,t}$ in more detail in the calibration section.

4.2.5 Asset Market

One option which agents can deposit their savings is the corporate bonds issued by intermediate firms (when they finance the initial fixed cost F_{EM}). The return on the corporate bond equals the dividend price ratio $\frac{\delta_{EM}\Pi_{EM}}{V_{EM}}$ plus the capital gain $\frac{\dot{V}_{EM}}{V_{EM}}$. This return is equal to the world interest rate r (which is exogenously given). At time t, this relationship is given by:

$$r_t V_{EM,t} = \delta_{EM,t}\Pi_{EM,t} + \dot{V}_{EM,t} \tag{4.14}$$

Since we investigate the asset shortage problems in EMs, it is natural to focus on a 'small' open economy, suggesting that the EM region takes the interest rate as given, or put differently, the EM region is too small so it cannot affect the world equilibrium interest rate r_t.

Furthermore, we assume that, within each region, there exists a local asset called L, which pays the same interest rate as the corporate bond. However, while asset L is not traded on the international market, meaning it can only be purchased by locals whereas corporate bonds can be purchased by both locals and foreigners. Furthermore, for reasons of riskiness, liquidity and home bias, we assume each agent has a strict preference as to the type of asset in which he chooses to store his savings.

Assumption 1 (Preference of Assets): Each agent has a strict preference within different asset classes. In particular, they will firstly satisfy their needs with domestic corporate bonds that can be traded internationally, due to higher liquidity, followed by local asset L, because of home bias, and lastly foreign bonds.

Moreover, due to the inability to supply assets, we assume that local asset supply is capped at $\bar{L}$. Finally, we introduce the definition of current account balance in region EM:

$$CA_t^{EM} = \dot{W}_{EM,t} - \dot{V}_{EM,t} \tag{4.15}$$

4.2.6 Calibration

Let us now calibrate the parameters for the EM region. For simplicity, we assume standard preference parameters, with the inter-temporal elasticity of substitution being the same for the final goods producer and household's final good consumption, which is fixed at $\theta = 2.1$. The time discount factor for the household is set at $\tau = 0.02$ to match the average median real interest rate in our EM country sample between 2002 and 2010. The productivity φ follows a Pareto distribution, with shape parameter α equal 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 AE, they estimate shape parameter α across different manufacturing industries. The exogenous entry and exit rate is calibrated to 5.5 percentage points, which was calculated as the (yearly) average of the firm entry and exit in EMs between 2002 and 2006 for a country like China (see also Brandt, Biesebroeck, and Zhang (2009)). The initial fixed cost (F_{EM}) is set to equal 0.32, which is calibrated to the ratio between total fixed investments as a share of total output across EM manufacturing industries.

The world interest rate is assumed equal to 3 percentage points. To make the model more manageable, we assume $f_{EM,t}(i) = \frac{\pi_{EM,t}(i)}{\pi_{\infty}(i)} \frac{F_{EM}}{\delta}$, by making this simplification assumption the number of state variables which we need to keep track of, is significantly reduced. Finally, since it is difficult to measure borrowing abilities directly, we calibrate the value of φ_{EM} to 0.12 following Caballero, Farhi, and Gourinchas (2006).

Given this initial calibration in region EM, we now explore a few scenarios, which we will lay out in the parameter calibrations in the AE region.

4.2.7 Quantitative Analysis - An Asset Supply Shock

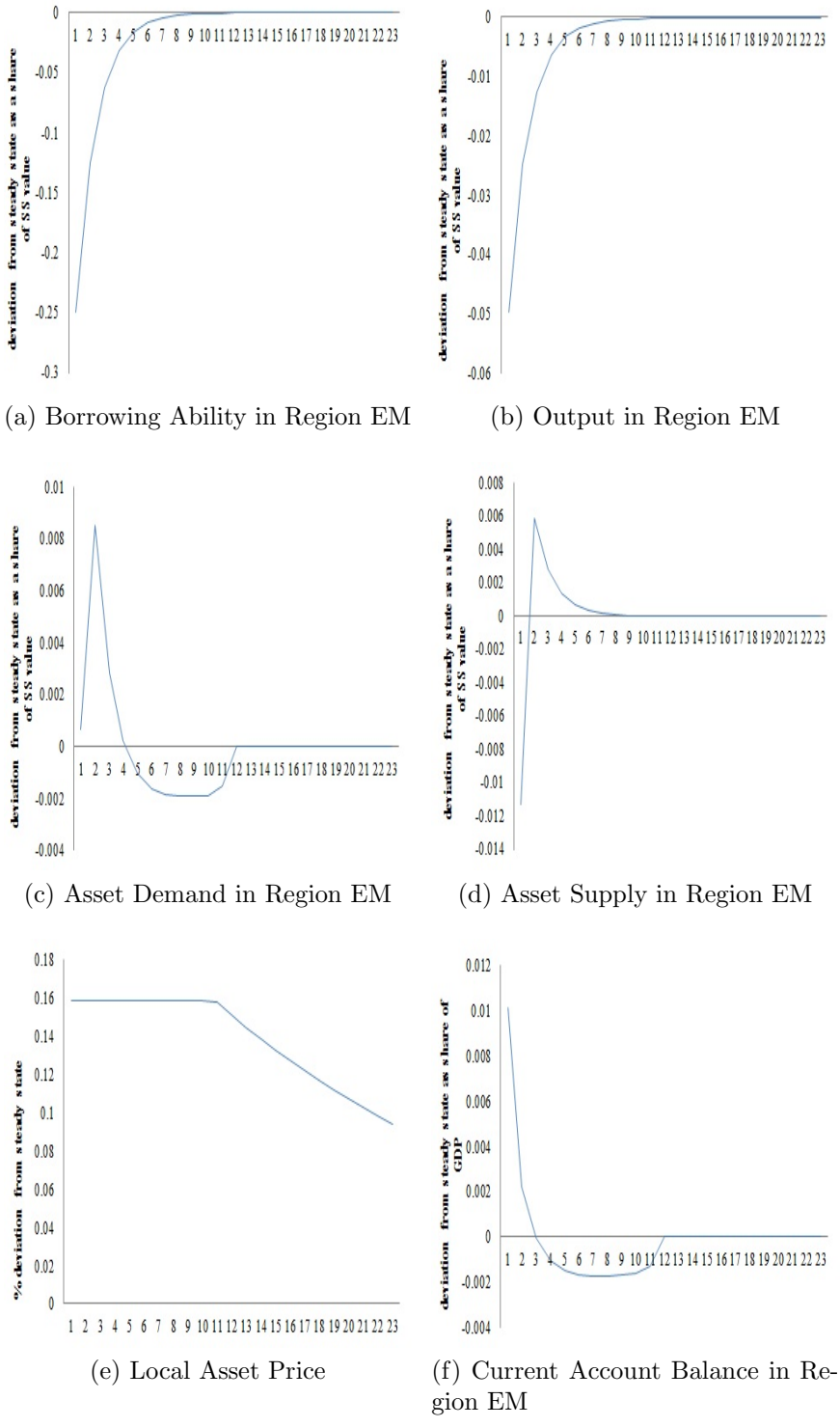
We focus on the analysis of a temporary collapse in δ_{EM}. This shock is analogous to the existence of asset shortages in region EM when investable asset growth lags behind savings growth. This could be spurred by structural reforms that facilitate entrepreneurship. In order to reveal the impacts and mechanisms of this shock, we assume that both region EM and AE start in the same steady state prior the shock. Put differently, all the results are driven by the shock.

Assumption 2 (Initial Conditions): The world is initially symmetric, more specifically, $\delta_{EM} = \delta_{AE}$, implying no initial asset shortage across regions.

Suppose now, unexpectedly at $t = 0$, δ_{EM} drops temporally to $\delta_{EM} < \delta_{AE}$. The fall in δ_{EM} in general could result from a structural reform or a change in monetary policy, for instance see Chapter 3 for a detailed analysis of asset shortages. After the shock, asset shortages appear in region EM.

Note that the definition for current account in this chapter excludes unexpected capital gains and losses from international positions. It is not of relevance, since at date 0, agents are assumed not to be holding international assets. Also note that, since $CA_t^{EM} + CA_t^{AE} = 0$, by characterizing the CA of EM, by default we also describe the CA of AE. Henceforth, we will focus on describing the behavior of CA_t^{EM}, with the understanding that this concept describes features of the global equilibrium rather than EM-specific features.

One caveat, standard models imply that capital flows from low to high growth economies; we argue that this conclusion does not carry over to a



(a) Borrowing Ability in Region EM

(b) Output in Region EM

(c) Asset Demand in Region EM

(d) Asset Supply in Region EM

(e) Local Asset Price

(f) Current Account Balance in Region EM

Figure 4.1: Responses of the Key Variables After the Borrowing Ability Shock

situation in which productive agents have limited ability to generate assets in order to carry out investment. In particular, the inability to generate assets in the EM region implies an uphill capital flow, as illustrated in empirical work by Lucas ('Lucas paradox').

Figure 4.1 characterizes the path for some key variables following the collapse of δ_{EM} calibrated so that Region EM's borrowing ability falls by 25 percent (see Panel a). Panel b shows the output falls by 5 percent immediately after the shock. The reason behind this fall in output is the inability to channel domestic savings to investment opportunities, which is reflected in Panels c and d. When savings in the EM region rise above and beyond the size of domestic corporate bonds, agents will increase their demand for local assets (due to home bias), thereby driving up the price of local assets (see Panel e). Since the local asset supply has a limit (due to the lack of asset issuance in region EM), the excess savings is channeled to foreign investable assets (see Panel f).

To recap, the calibration implies that an asset shortage leads to a slowdown in economic growth, an increase in local asset prices (potentially leading to a crisis if the asset shortage is excessive), and current account imbalances. Having calibrated the model, we will now econometrically estimate the relationship for our sample of EMs using macroeconomic data, and will confirm that asset shortages, as developed by in Chapter 3, constrain economic growth, lead to domestic asset bubbles and ultimately a crisis, while also causing current account surpluses.

4.3 Consequences of Asset Shortages

4.3.1 Economic Growth

This section will demonstrate that asset shortages owing either to insufficient investment opportunities or to savings not being properly intermediated hold back economic growth. In the real world, the intermediation of savings, either via banks or capital markets, to those who have investment projects with net present values is crucial. Without this intermediation, investment would not get financed, leading to suboptimal growth (see also King and Levine (1993a) and King and Levine (1993b)). It is not enough for countries to generate savings if there is a lack of assets through which savings can be intermediated

(see Chen and Imam (2011)).

Asset shortages, as measured by the asset shortage index, is therefore likely to have an asymmetric impact on growth. Countries with asset shortages are likely to have credit-constrained firms, thereby holding back growth. If there is an excess supply of financial assets, the impact on growth is likely to be more ambiguous, because financing can also come from overseas if domestic savings is insufficient and these 'excessive' cheap fundings can increase investors' risk appetite and have adverse effect on economic growth, as may be the case in countries such as the US and UK. To test this proposition, the AS-index is divided into two variables: (i) AS-index above zero corresponding to a country with asset shortages at a given period of time, and (ii) AS-index below zero representing asset surplus. We will also differentiate between the impact of asset shortages on short-term and on long-term growth. The country classification is provided in Table 4.10. The source of data are displayed in Table 4.11, 4.12, 4.12, 4.13, 4.14 and 4.15.

Short-Run Relationship

As many of the variables explaining asset shortages are potentially endogenous, to empirically assess the impact of asset shortages on growth, we make use of system-GMM. Another concern is robustness, as estimators are often sensitive to other conditional variables (Sala-i Martin (1997); Levine and Renelt (1992) and Durlauf, Johnson, and Temple (2005)). Therefore, an approach suggested by Bosworth and Collins (2003) is adopted, in which the focus is on a core set of explanatory variables that have been associated consistently with growth. We then evaluate the importance of other variables conditional on inclusion of the core set. Based on the existing literature, the following variables are therefore included as core explanatory variables: previous economic growth, real effective exchange rate (REER), inflation and real interest rate. Other variables such as: corruption, government deficit, world GDP growth, GDP per capita, legal origin, US interest rate, total trade as share of GDP, and percentage of secondary school enrollment as a proxy of human capital are then augmented with the core regressors.

$$\begin{aligned} \Delta GDPGrowth_{it} &= \beta_1 \Delta ASIndex(above0)_{it} \\ &+ \beta_2 \Delta ASIndex(below0)_{it} \\ &+ \beta_3 \Delta GDPGrowth_{i,t-1} + \beta_4 \Delta REER_{i,t-1} \end{aligned}$$

$$+ \quad \beta_5 \Delta Inflation_{i,t-1} + \beta_6 \Delta Inflation^2_{i,t-1}$$
$$+ \quad \beta_7 \Delta RealInterestRate_{i,t-1} + \beta_8 X + \varepsilon_{it} \quad (4.16)$$

where X is a matrix containing all the additional variables not included in the core regression, and β_8 is the corresponding coefficient vector. Note that the Hansen J-test and Arellano-Bond[2] tests both confirm that the set of instruments chosen for the estimation is valid, in the sense that the instruments are uncorrelated with the error terms, and they satisfy the additional restriction on the first difference.

The evidence from the econometric estimation is unambiguous. Asset shortages negatively affect growth, while an asset surplus has no discernible impact. The results suggest a negative relationship between change in the AS index (truncated above zero) and subsequent GDP growth. A 1 percentage point increase in asset shortages is associated with a slowdown in annual GDP growth of around 0.7 percentage points, consistent with our original hypothesis. This implies that, as firms become financially constrained and unable to borrow to meet the desired level of investment, and savings are not allocated where they are needed, growth slows down.

The findings are robust to different specifications of the regression, as displayed in Table 4.1, with our premises mostly confirmed. In particular:

- GDP growth. If an economy has grown rapidly in the recent past, it will revert back to a more sustainable growth rate.
- Inflation. There is evidence that inflation is statistically significant and non-linear. While inflation has a mild positive impact on growth when it is contained, its impact becomes negative beyond a certain threshold.
- Real interest rate. A higher real interest rate is significantly negatively correlated with GDP growth, as high interest rates render borrowing more expensive.
- Real exchange rate. While the real effective exchange rate is statistically significant and positive, the coefficient is close to zero. This implies

[2]We noticed that the Arellano-Bond test statistics are 'too' high in some of the regression specifications, which poses potential problem - invalidity of the instruments, however panel fixed effect estimations are also implemented in parallel as robustness check. The results are similar between two estimation procedures moreover, estimation results on other variables are consistent with the existing literature therefore we believe the results from GMM estimations reflect the true estimates with certain degree of consistency.

Table 4.1: System GMM Regression Results for Explaining GDP Growth

	ΔGDP Growth									
Independent Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δ AS index	-0.135*									
	(0.079)									
Δ AS index		-0.695**	-0.695**	-0.875**	-0.683**	-0.696**	-0.692**	-0.670**	-0.692**	-0.673**
(truncated above 0)		(0.317)	(0.321)	(0.427)	(0.316)	(0.319)	(0.320)	(0.320)	(0.319)	(0.319)
Δ AS index		-0.016	-0.016	0.029	-0.001	-0.017	-0.0211	-0.019	-0.018	-0.018
(truncated below 0)		(0.066)	(0.067)	(0.090)	(0.068)	(0.066)	(0.068)	(0.066)	(0.066)	(0.067)
Δ GDP growth (t-1)	-0.281***	-0.273***	-0.273***	-0.284***	-0.294***	-0.275***	-0.276***	-0.282***	-0.277***	-0.284***
	(0.037)	(0.040)	(0.041)	(0.045)	(0.042)	(0.041)	(0.0392)	(0.041)	(0.041)	(0.041)
Δ REER	0.001***	0.001***	0.001**	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Δ Inflation	-0.394***	-0.386***	-0.386***	-0.506***	-0.408***	-0.388***	-0.389***	-0.392***	-0.390***	-0.394***
	(0.106)	(0.106)	(0.108)	(0.123)	(0.108)	(0.108)	(0.107)	(0.108)	(0.107)	(0.107)
Δ Inflation squared	0.002**	0.002**	0.002**	0.003***	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ Real interest rate	-0.184***	-0.182***	-0.182***	-0.178***	-0.159***	-0.181***	-0.181***	-0.174***	-0.180***	-0.174***
	(0.035)	(0.034)	(0.034)	(0.039)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Δ Corruption			-0.004							
			(0.426)							
Government deficit				0.015						
				(0.019)						
World GDP growth					5.840***					
					(1.883)					
GDP per capita						0.000009				
						(0.00001)				
Common law							0.262**			
							(0.115)			
Secondary edu.								0.005*		
(percentage)								(0.003)		
US interest rate (t-1)									0.028	
									(0.033)	
Total trade/GDP (t-1)										0.003**
										(0.001)
Arellano-Bond test for AR(2) in first diff	0.388	0.401	0.398	0.396	0.383	0.396	0.393	0.368	0.360	0.367
Hansen test of overide restrictions	0.92	0.95	0.90	0.93	0.92	0.91	0.92	0.92	0.92	0.92

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

that its impact on growth matters, though only in a limited way. This could reflect the heterogeneity of our sample, which includes commodity producers and manufacturing economies, which have very different elasticities of exports and imports.

We now turn to the additional variables entered into the base regression separately.

- Government deficit. Government deficit is positively correlated with GDP growth, but is not statistically significant. This implies mild evidence for the validity of the Ricardian equivalence in EMs, which postulates that consumers internalize government's budget constraint. Taxpayers put aside savings to pay for expected future tax increases, offsetting any positive impact of a budget deficit on growth.

- World GDP growth. World GDP growth, a proxy for overseas economic conditions, has a positive and significant impact on domestic GDP growth. Better global growth means higher exports and positive effects on consumer and investor confidence.

- US interest rates. US interest rates, a proxy for worldwide monetary policy, have a positive impact on domestic GDP growth. One hypothesis would be that higher US interest rates, by making it more difficult to borrow overseas, might encourage local investors to borrow domestically instead, thereby stimulating growth.

- GDP per capita. GDP per capita is positively correlated with GDP growth but is not statistically significant. While we therefore do not see evidence of a convergence effect, this might be because all of our countries are part of a similar income group, suggesting that they may already have converged to similar steady states.

- Openness. More openness, by encouraging specialization in the production of goods and services, benefits the domestic and the world economy.

- Common law. UK legal origin, a proxy for common law, has a positive and statistically significant effect on GDP growth, as confirmed in several studies. According to this literature, common law is more creditor friendly than civil law, and hence creates a more dynamic economy (La Porta, Lopez-de Silanes, Shleifer, and Vishny (1997)).

- Corruption. Change in corruption has no significant impact on GDP growth. Corruption is not always bad for growth, if, like a tax, it is predictable and facilitates transactions. Some studies have suggested that in EMs, notably in East Asia, greasing the wheels of government may have helped spur growth (Khan (2001)).

- Human capital. Human capital, as one would expect from theory, is an important factor determining GDP growth.

Long-run Relationship

This subsection examines the long-run nature of the relationship between asset shortages and economic growth. Thus far, we have looked at their short-run relationship, ignoring both whether a long-run relationship exists and causality. We first use a panel unit root (Im, Pesaran, and Shin (2003)) and panel co-integration tests (Pedroni (1999) and Pedroni (2004)) to determine the long-run relationship. These allow for heterogeneity in coefficients and different dynamics across units. This enables us to determine the long-run structure of the asset shortage and growth relationship, avoiding the problems of low power that occur in traditional (time series) co-integration testing owing to the small samples. We also test the direction of the causality by employing a panel co-integration causality test (Canning and Pedroni (2008)).

Before embarking on co-integration techniques, we need to test for non-stationarity against the alternative that the variables are trend stationary, where we allow different intercepts and time trends for each country. We adopt the Im, Pesaran, and Shin (2003) approach, which allows each panel member to have a different autoregressive parameter and short-run dynamics under the alternative hypothesis of trend stationarity. The variables GDP growth and the AS index are tested both in levels and in first difference. We cannot reject the null hypothesis (i.e., unit root) at levels; however, the null hypothesis is rejected at the 1 percent significance level when differences are tested. In what follows, we therefore proceed on the assumption that all variables are I(1) and all difference variables are I(0) (Table 4.7).

As the order of stationarity has been confirmed, we next turn to the question of possible co-integration between asset shortage and GDP growth. Given the possibility of reverse causality between the two variables, the panel co-integration technique of Pedroni (1999) and Pedroni (2004) is adopted. It is

robust to causality in both directions and allows for both heterogeneous co-integrating vectors and short-run dynamics across countries. More formally, we test the following specification:

$$GDPgrowth_{it} = a_i + b_t + \beta_i ASIndex_{it} + e_{it} \tag{4.17}$$

where each country has its own unique relationship between GDP growth and the AS index. The variable e_{it} represents a stationary error term. Furthermore, we allow for the slope of the co-integration relationship to differ from unity across countries. The common yearly dummy b_t captures any factors that affect all countries at a given time[3]. The findings in Table 4.2 confirm that, for all countries, we can reject the null hypothesis of no co-integration. Consequently, in what follows, we can assume co-integration between the AS index and GDP growth.

Table 4.2: Panel Co-integration Test

panel v-stat	=	0.92779
panel rho-stat	=	-4.40936***
panel pp-stat	=	-8.66264***
panel adf-stat	=	-7.86769***
group rho-stat	=	-1.20192
group pp-stat	=	-9.32220***
group adf-stat	=	-7.87350***
N = 39		T periods = 14

Note: All reported values are distributed N (0,1) under null of unit root
Panel stats are weighted by long-run variances. or no co-integration

Having established the existence of a long-run relationship, we tackle the issue of causality. The causality tests can be implemented on a country-by-country basis (Table 4.3). The countries have been grouped by region. Column 2 reports the point estimate for λ_{2i}, column 3 reports the associated t-test for the null hypothesis that $\lambda_{2i} = 0$ and column 4 reports the corresponding p value for the test result from column 3. Columns 5 to 7 report the analogous results for λ_{1i}, and the last column reports the estimate for the 'sign' ratio $\frac{\lambda_{2i}}{\lambda_{1i}}$. The results for most countries imply that causality runs from asset shortages to economic growth, with the impact being negative on growth. Growth on the other hand does not have a causal impact on asset shortages in most countries. In practice, the reliability of the various point estimates

[3]Following Pedroni (2004), we use the residual of the above regression to construct the group mean ADF test for the null hypothesis of no co-integration. The lag length for the ADF-based tests is allowed to vary across different cross-sections, and the optimal lag is chosen by the step-down procedure beginning with a maximum of five lags. The test has a normal distribution under the null hypothesis of no co-integrations.

and associated tests for any one country is likely to be less reliable due to the short sample period. Consequently, the focus is on the results reported in the panel data. The panel tests for the direction of long-run causality and the sign of the long-run causal effect are reported in the last two rows of Table 4.3. They support the view of a negative long-run causality from asset shortage to economic growth, and reject the null hypothesis of a long-run causality from economic growth to asset shortage. Furthermore, the group median sign ratio test indicates that economic growth is associated with a positive causal effect.

Table 4.3: Panel Causality Test Results for 39 Countries during 1995 - 2008

	λ_2: GDP $Growth_{it} \rightarrow AS_{it}$			λ_1: $AS_{it} \rightarrow$ GDP $Growth_{it}$			$-\lambda_2/\lambda_2$
Country	Estimate	Test	P value	Estimate	Test	P value	Estimate
Latin America							
Argentina	0.25	1.33	(0.18)	0.53	0.55	(0.58)	-0.47
Brazil	3.15	1.44	(0.15)	-12.05	-1.69	(0.09)	0.26
Chile	-0.01	-0.03	(0.98)	-1.66	-2.88	(0.00)	-0.01
Colombia	0.13	0.92	(0.36)	-3.17	-2.39	(0.02)	0.04
Mexico	0.12	0.66	(0.51)	-1.77	-1.05	(0.29)	0.07
Panama	0.61	0.97	(0.33)	-0.47	-1.8	(0.07)	1.30
Peru	-0.24	-0.85	(0.40)	-0.4	-3.14	(0.00)	0.60
Venezuela Rep.	-0.01	-0.11	(0.91)	-2.54	-0.93	(0.35)	-0.01
East Asia							
China PR	0.44	2.13	(0.03)	-1.47	-2.72	(0.01)	0.30
China Hong Kong	0.34	0.12	(0.90)	-1.79	-1.38	(0.17)	0.19
India	0.04	0.30	(0.77)	-0.93	-2.67	(0.01)	0.05
Indonesia	0.01	0.78	(0.44)	-0.57	-6.07	(0.00)	0.01
Korea	0.73	2.70	(0.01)	-2.61	-1.95	(0.05)	0.28
Malaysia	-1.83	-2.12	(0.03)	-0.90	-0.52	(0.60)	-2.03
Philippines	-0.32	-0.23	(0.82)	-0.72	-0.4	(0.69)	-0.44
Thailand	0.03	0.87	(0.38)	-0.75	-3.12	(0.00)	0.05
Vietnam	-0.3	-0.96	(0.34)	-1.24	-1.07	(0.28)	-0.24
Mid. East							
Bahrain	2.03	0.29	(0.77)	-0.18	-0.16	(0.87)	11.04
Egypt	-0.01	-0.02	(0.99)	-0.74	-0.41	(0.68)	-0.01
Israel	0.19	3.31	(0.00)	-1.18	-1.24	(0.22)	0.16
Kazakhstan	0.01	0.08	(0.94)	-0.85	-1.83	(0.07)	0.01
Kuwait	-0.08	-1.25	(0.21)	-0.82	-0.9	(0.37)	-0.08
Morocco	-0.51	-0.98	(0.32)	-0.83	-0.68	(0.49)	-0.62
Pakistan	0.13	1.94	(0.05)	-0.56	-0.71	(0.48)	0.23
Saudi Arabia	-0.07	-0.25	(0.80)	-1.16	-0.84	(0.40)	-0.06
South Africa	-3.38	-0.86	(0.39)	-0.45	-0.41	(0.68)	-7.57
Turkey	-0.09	-3.49	(0.00)	-2.33	-2.66	(0.01)	-0.04
Eastern Europe							
Bulgaria	1.31	2.33	(0.02)	0.44	0.68	(0.50)	-3.00
Croatia	0.23	0.62	(0.54)	-0.53	-1.16	(0.25)	0.43
Czech Rep.	-0.28	-0.26	(0.79)	-1.22	-0.66	(0.51)	-0.23
Hungary	-0.14	-0.18	(0.86)	-1.48	-0.99	(0.32)	-0.10
Latvia	-0.27	-0.43	(0.67)	-2.40	-0.74	(0.46)	-0.11
Lithuania	-0.08	-0.18	(0.86)	-1.90	-0.69	(0.49)	-0.04
Poland	0.17	0.47	(0.64)	-0.90	-1.18	(0.24)	0.18
Romania	0.06	0.41	(0.69)	-0.60	-1.93	(0.05)	0.10
Russia	-0.02	-1.06	(0.29)	-0.66	-8.67	(0.00)	-0.03
Slovak Rep.	0.54	0.64	(0.53)	-2.32	-3.07	(0.00)	0.23
Slovenia	0.01	0.01	(0.99)	-2.60	-2.66	(0.01)	0.00
Ukraine	0.04	0.81	(0.42)	-0.62	-1.71	(0.09)	0.07
Group mean	0.08	0.25	(0.60)	-1.45	-1.69	(0.05)	0.00
Lambda Pearson		106.93	(0.02)		287.95	(0.00)	(0.05)

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

These results imply strong causality from asset shortages to economic

growth. Moreover, the point estimate is negative, meaning that a higher asset shortage leads to lower economic growth, with the finding being robust for most countries in our sample.

4.3.2 Asset Bubbles

We argued in Chapter 3 that asset bubbles have become ever more frequent. Empirically, however, it is difficult to test for asset bubbles ex ante. Theoretically, rising asset bubbles tend to be (i) caused by macroeconomic factors (e.g., overheating), or (ii) are driven by speculation. It is crucial to identify which one of these two reasons may lead to a crisis in EMs, as the policy implication can be very different. Economists typically identify the two forces by investigating the extent to which macroeconomic variables explain asset prices, and the variation that cannot be explained is assumed to be driven by speculative demand. Owing to market imperfections, and given rising evidence from behavioral finance that economic agents are driven by psychology (overconfidence, heuristic bias, framing etc.) as much as by fundamentals, the assumption that asset prices reflect market fundamentals does not always hold. Therefore, asset prices can deviate from market fundamentals. One factor that to our knowledge has not been explicitly tested is the impact of asset shortages on bubbles. As Tirole (1985) argued, it is always difficult to identify the right set of variables as proxy for market fundamentals. At the same time finding an appropriate measure to proxy the speculative demand is also not an easy task, however, we expect the asset shortage index captures the 'speculative demand' to certain degree.

Our analysis begins by constructing an index to proxy asset over-valuation. The methodology is based on the bubble-o-meter used in the GFSR (2010). The asset bubble is a weighted average of three z-scores corresponding to three major assets for each country[4]. The three asset classes used to construct the asset bubble index are (i) equity, measured by a forward-looking (shorter horizon) 12-month price-to-earnings ratio; (ii) housing market, proxied by a price-to-rent ratio by rescaling residential house prices by rental rates; and (iii) local sovereign bonds, estimated by local sovereign yield. The z-score represents the deviation of the latest observation from the model prediction and is demeaned and normalized by its standard deviation. This provides a natural standardization for the three asset classes.

[4]Other assets should also be included, for example, corporate bond; but because of data limitations in emerging economies, they are not considered in this chapter.

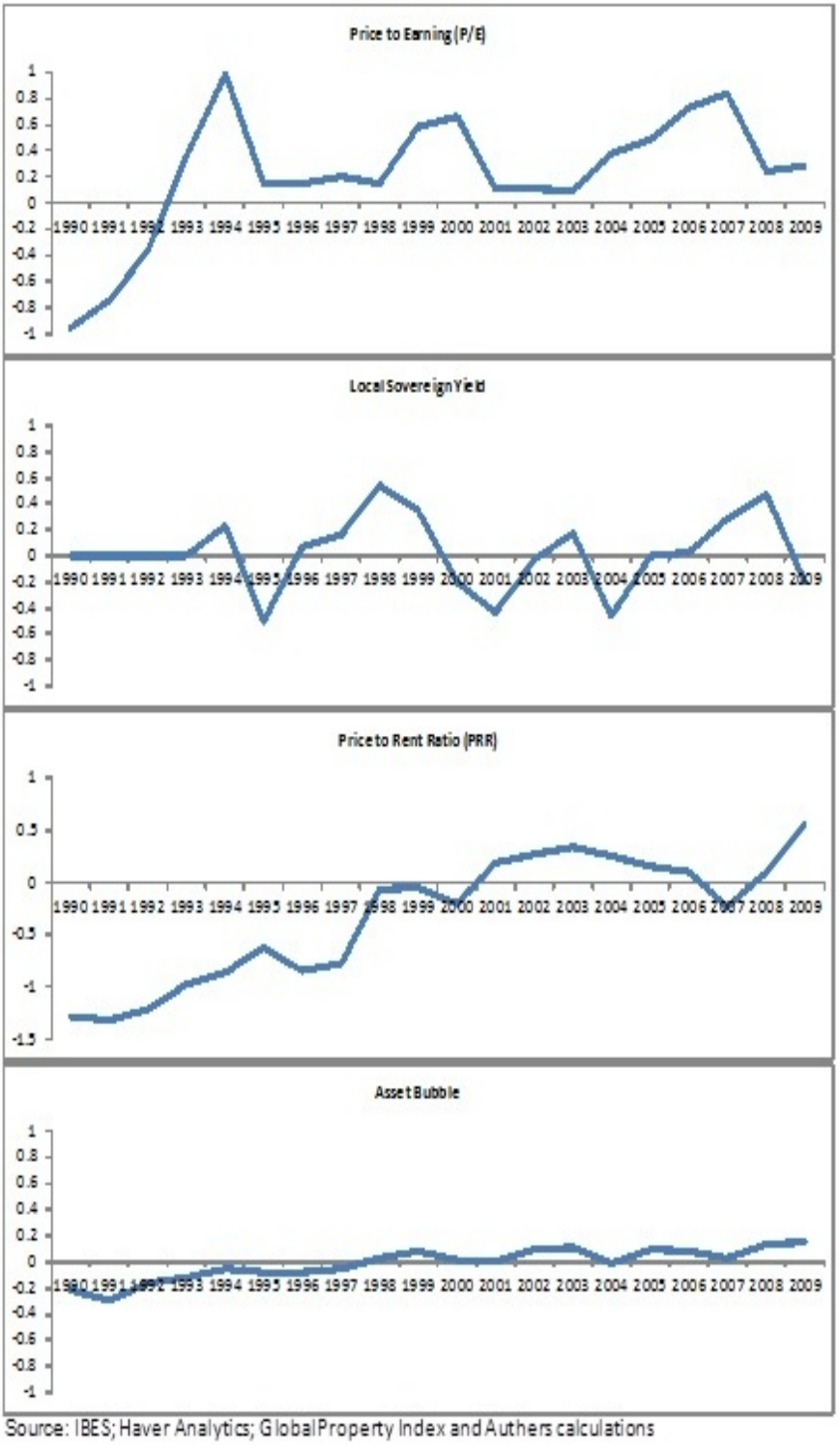


Figure 4.2: Asset Bubbles in EMs for Equity, Government Bonds, and Housing Market (z-score) between 1990 and 2008

There is some evidence in our sample of countries that prices have increased gradually over time for assets, though with variation across asset classes (Figure 4.2). The housing market in EMs followed a similar pattern to that in AEs, with a steady rise in the deviation of house prices from fundamentals, even after the 2008 crisis. The equity market in EMs also has deviated above its equilibrium in recent years, though with the volatility often associated with a crisis. The z-scores for domestic sovereign bonds show a mean reversion process, meaning that a below-model predicted yield is always followed by a higher-than-model predicted valuation.

The intent is to estimate whether asset shortages are a key driver of asset bubbles in EMs. We want to test whether the AS index has a significant impact on the deviation of asset prices as predicted by its market fundamentals. Besides the AS index, we use a set of macro variables that are deemed important in determining asset prices: domestic GDP growth, inflation, real interest rate, government fiscal balance, real effective exchange rate (REER), legal origin, and dependency ratio. Moreover, variables that explain the international macroeconomic environment, namely US interest rates and world GDP growth, are also taken into account. The core regression has the following form:

$$\begin{aligned} \Delta BubbleIndex_{it} &= \beta_1 ASIndex_{it} + \beta_2 GDPgrowth_{it} + \beta_3 Inflation_{it} \\ &+ \beta_4 RealInterestRate_{it} + \beta_5 X + \varepsilon_{it} \end{aligned} \tag{4.18}$$

To deal both with the possibility of reverse causality and omitted variable bias, system-GMM is again employed. Note that we lead all variables by one year, as we assume that asset prices are priced using expectations; hence they are not affected by contemporaneous variables, but by expected future ones. Before deciding whether to use level effects or first difference, we test for unit roots, with evidence of first difference, but not level effects (Table 4.8). We therefore use first differences in asset bubble index as the dependent variable.

The results (Table 4.4) provide evidence of a strong positive link between asset shortages and asset bubbles. Asset bubbles increase when asset shortages worsen. Columns 1 - 14 show that the coefficients are positive and are statistically significant at the 5 percent level. The results imply that asset prices will deviate from fundamentals if there is excess demand expected in the next period.

Table 4.4: System GMM Panel Regression for Asset Bubbles 1995 - 2008

	Δ Asset Bubble Index													
Independent var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Asset shortage index	0.032**	0.031**	0.031**	0.033**	0.031**	0.031**	0.032**	0.031**	0.032**	0.031**	0.030**	0.030**	0.0285**	0.032**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)	(0.013)	(0.0130)	(0.013)
GDP growth	-0.335	-0.331	-0.333	-0.309	-0.542	-0.449	-0.395	-0.504	-0.825**	-1.005**	-0.853**	-0.704*	-0.783*	-0.797**
	(0.250)	(0.250)	(0.251)	(0.253)	(0.341)	(0.330)	(0.340)	(0.339)	(0.411)	(0.456)	(0.391)	(0.393)	(0.412)	(0.365)
Inflation	0.010**	0.009**	0.010**	0.011**	0.006	0.009**	0.009**	0.008**	0.007**	0.006*	0.008**	0.005	0.00603*	0.002
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.00381)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.00341)	(0.004)
Real interest rate	-0.008	-0.025	-0.014	0.016	-0.090	-0.043	-0.011	-0.055	-0.127**	-0.169**	-0.152**	-0.091*	-0.112*	-0.060*
	(0.057)	(0.056)	(0.080)	(0.069)	(0.065)	(0.061)	(0.055)	(0.059)	(0.058)	(0.077)	(0.062)	(0.051)	(0.0602)	(0.059)
Govt. fiscal balance		-0.001												
		(0.002)												
REER			0.001											
			(0.005)											
Legal origin: UK				-0.012										
				(0.014)										
Dependent ratio					0.240*									
					(0.144)									
US interest rate						0.003								
						(0.005)								
World GDP growth							0.073							
							(0.198)							
Inst. regulation (t-1)								0.023						
								(0.020)						
Financial freedom (t-1)									0.0009**					
									(0.0004)					
Business freedom (t-1)										0.001***				
										(0.0003)				
Property rights (t-1)											0.001***			
											(0.0003)			
Government stability (t-1)												0.005**		
												(0.002)		
Law and order (t-1)													0.0124**	
													(0.00568)	
World commodity prices														0.0006**
														(0.0002)
Arellano-Bond test for AR(2) in difference	0.108	0.108	0.110	0.108	0.108	0.106	0.107	0.109	0.116	0.120	0.121	0.107	0.108	0.108
Hansen test overide Rest.	0.93	0.96	0.96	0.93	0.96	0.96	0.98	0.96	0.94	0.96	0.96	0.96	0.98	0.97

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Most fundamental factors GDP growth, interest rates, fiscal balance, real effective exchange rate and legal origin do not have a significant impact on the asset bubble index. This confirms that non-fundamental factors, such as psychology and market imperfections, matter more in explaining bubbles. The coefficient of GDP growth is insignificant. Similarly, real interest rates are not statistically significant, which could be either a reflection of the limited allocative capacity of interest rates in some EMs, or more likely the fact that bubbles, reflecting non-fundamental factors, are unaffected by interest rate changes, except if they are increased sharply, which rarely happens. Fiscal balance, REER, and legal origin also are insignificant factors.

Future inflation has a positive and statistically significant impact on the asset bubble index. This could reflect the fact that increasing inflation, a measure associated with rising macroeconomic instability, encourages economic actors to hedge themselves by buying assets such as equity and housing, which are either natural hedges or which have some intrinsic value.

The dependency ratio - the share of the population under 15 and over 65 over working population - has a positive impact on asset prices. In principle, following the life-cycle hypothesis, a young population with a low dependency ratio should lead to rising asset prices. The demographic transition, characterized by an increase in the active labor force, raises demand for housing and financial assets. Therefore, an initially falling dependency, typically leads to rising housing and financial asset prices, creating potentially bubbles. However, Chapter 1 illustrates a significant share of the population in EMs violate the permanent income hypothesis due to the existence of liquidity constraint. Likewise, these liquidity constrained - unable to borrow against future income - young working population will not able to raise demand for housing and financial assets. Whereas, later on in their life time, they would either have much higher income or accumulated a sizable stock of assets (enough to relax the liquidity constraint) therefore start buying houses or invest in other financial assets. As a result, Chapter 1 predicts dependent ratio should be positively correlated with asset prices when liquidity constraint exist, which is a common theme in EMs. Our regression results confirm that the dependency ratio is positive and significant at 10 percent, suggesting that as a population ages, asset prices are likely to rise, though the effect is not very strong.

World commodity prices have a positive and significant impact on the as-

set bubble index. This result is not unexpected, because rising commodity prices lead to large inflows of capital into commodity producing EMs; this reduces the availability of financial assets for domestic investors, thereby raising prices of domestic assets. Even though rising commodity prices in general reflect a healthy growing economy, the supply of financial assets does not appear to rise commensurately, because commodity producing countries often finance themselves overseas or through the cash flow generated by projects, which does not directly lead to a supply of financial assets.

US interest rates and world GDP growth, proxies for the international macroeconomic environment, both have insignificant effects on asset bubbles in EMs. This implies that asset bubbles are country specific phenomena, not global. Global factors have a limited impact on EM asset prices, because domestic regulatory and market imperfections create entry and exit barriers in domestic asset prices (see Chen and Imam (2011)).

The regression results suggest that business friendly regulatory environments increase the probability of asset bubbles. Whether measured by business and financial freedom, property rights, government stability, or law and order, better regulatory environments, perhaps by providing a false sense of security, may increase the demand for financial assets disproportionately, thereby allowing asset bubbles to increase. Whereas the impact of institution regulation is insignificant.

In sum, the regression estimates suggest that asset shortages have a significant impact on asset prices. The natural question is: can asset shortages also 'explain' the probability of a crisis?

4.3.3 Probability of A Crisis

Asset shortages are more likely to increase the probability of a crisis, because too much money chasing too few financial assets leads to bubbles that if excessive can end in a crisis. Rising prices tend to create euphoria and will attract the attention of investors. Herd behavior in turn reinforces pricing bubbles, which eventually burst.

A probit estimation is used to study the effect of asset shortages on the probability of crisis together with an additional set of macroeconomic vari-

ables. The dependent variable (Crisis) is a binary dummy variable that takes the value of 1 in the year crisis occurs and 0 otherwise. The regression results are presented in Table 4.5. A set of key variables identified in the literature as major causes of crisis, including the AS index, were selected for the econometric estimation: the log of GDP, real interest rate, a country's credit rating, government deficit, *de facto* exchange rate, inflation, and log of GDP per capita. The analysis tests the effect of legal origin, US interest rates, external debt, government debt, government revenue, REER and foreign asset liability and assets in separate regressions. Our probit regression follows:

$$\begin{aligned} Crisis_{it} &= \beta_1 ASIndex_{it} + \beta_2 ln(GDP)_{it-1} + \beta_3 RealInterestRate_{it-1} \\ &+ \beta_4 Country'sCreditRating_{it-1} + \beta_5 Govt.FiscalBalance_{i,t-1} \\ &+ \beta_6 DeFactoEx.Rate + \beta_7 Inflation_{i,t-1} \\ &+ \beta_8 GDPperCapita_{i,t-1} + \beta_9 X + \varepsilon_{it} \end{aligned} \tag{4.19}$$

where matrix X contains a set of additional variables added to the core regression.

The AS index has a significant and positive impact on the probability of a crisis. The coefficient on the AS index is positive and significant across different specifications of the regression. This means that a rise in asset shortages increases the probability of a crisis in the current year. Asset shortages could be a major source of crisis, by leading to a misallocation of assets. The imbalance between supply and demand, because it is not being addressed, results in assets appreciating beyond their fundamentals as illustrated in the previous section, leading to a crisis.

The coefficients of the real interest rate, income per capita, and GDP have no statistically significant impact on the probability of crisis. As argued earlier, the sensitivity of asset prices to interest rates does not seem very large, with interest rates not leading to an equalization of demand and supply of assets. Interest rates in EMs can increase or reduce the probability of a crisis, depending on the credibility of monetary policy, which is high in some EMs and low in others. The development level of an economy does not make a crisis more likely. The size of a country's economy and GDP per capita neither increases nor decreases the probability of a crisis, with the coefficients being insignificant. This is not necessarily surprising, as it is not clear why either bigger or smaller economies, or richer or poorer countries, should be

Table 4.5: Crisis Estimation Using the Probit Model

	Crisis								
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
AS Index	0.868***	0.850***	0.677**	1.018**	0.920**	0.827**	1.052***	1.066***	0.887***
	(0.329)	(0.326)	(0.276)	(0.440)	(0.361)	(0.385)	(0.363)	(0.389)	(0.345)
Log of GDP (t-1)	0.113	0.083	-0.001	0.265	0.116	0.356	0.046	0.0885	0.154
	(0.173)	(0.183)	(0.107)	(0.358)	(0.184)	(0.401)	(0.115)	(0.146)	(0.215)
Real interest rate (t-1)	0.017	0.019	0.007	0.016	0.0179	0.009	0.018	0.0183	0.0150
	(0.025)	(0.025)	(0.023)	(0.029)	(0.026)	(0.047)	(0.024)	(0.025)	(0.026)
Country's credit rating (t-1)	-0.580**	-0.577**	-0.439**	-0.549*	-0.612**	-0.696**	-0.495*	-0.566**	-0.594**
	(0.286)	(0.281)	(0.242)	(0.316)	(0.300)	(0.344)	(0.267)	(0.280)	(0.296)
Government deficit (t-1)	-1.091	-0.907	-0.169	1.802	-1.833	2.832	-3.575	-3.499	-1.109
	(8.596)	(8.287)	(6.742)	(9.750)	(8.759)	(9.735)	(7.516)	(7.955)	(8.892)
De facto exchange rate (t-1)	-0.386*	-0.384*	-0.335*	-0.426*	-0.444*	-0.572	-0.418**	-0.435*	-0.383*
	(0.217)	(0.212)	(0.190)	(0.249)	(0.248)	(0.382)	(0.210)	(0.224)	(0.224)
Inflation (t-1)	-0.532	-0.466	-0.256	-0.768	-0.597	-1.050	-0.369	-0.507	-0.602
	(0.510)	(0.520)	(0.296)	(0.854)	(0.566)	(0.901)	(0.425)	(0.498)	(0.581)
Log of GDP per capita	-0.311	-0.227	-0.161	-0.833	-0.318	-0.853	-0.149	-0.266	-0.426
	(0.515)	(0.535)	(0.313)	(1.126)	(0.548)	(1.102)	(0.339)	(0.440)	(0.632)
Common law		0.224							
		(0.725)							
US interest rate (t-1)			0.324**						
			(0.165)						
External debt				0.412					
				(0.374)					
Government debt					0.278				
					(0.461)				
Government revenue						-2.916			
						(2.407)			
Net domestic asset held by							-10.35**		
Foreign investors							(4.459)		
Net foreign asset held by							-5.645		
domestic investors							(3.698)		
Net domestic/foreign assets								-8.002**	
held by domestic investors								(3.950)	
REER									-0.0001
									(0.0003)
Pseudo R-squared	0.598	0.598	0.619	0.633	0.627	0.626	0.624	0.619	0.600
Observations	289	289	289	272	289	287	289	289	289
Number of id	32	32	32	32	32	32	32	32	32

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

more susceptible to a crisis.

A country's credit rating is statistically significant in explaining the probability of a crisis. The regression results suggest that, as the country's credit rating improves, the probability of a crisis decreases. The improvement of a country's credit rating is a reflection of better fundamentals in the domestic economy, and hence better buffers against a crisis.

The probability of crisis is negatively affected by exchange rate flexibility. In our sample, fixed change rate regimes are often observed before a crisis, for example, the Thai baht in 1997 and the Russian ruble in 1998. Defending the peg is difficult for any country on the eve of a crisis. Because a fixed exchange rate is difficult to defend in the absence of a sound fiscal balance sheet and a large accumulation of foreign reserves, it is often a source of crisis. However, the real effective exchange rate (REER) does not have a clear impact on the probability of a crisis. This could be because a sharp depreciation is normally observed after a crisis, so the causality is from crisis to real exchange rate.

Key macroeconomic variables such as inflation and budget balance do not appear to be significant in explaining the probability of a crisis. Government fiscal balance is not statistically significant, though it does have the correct sign. Although a budget deficit does not appear to be a key driver of crisis, it is certainly the case that entering a crisis with a large deficit makes it more difficult to use anti-cyclical policies. Similarly, there appears to be no close relationship between inflation and probability of crisis. Higher inflation, by raising instability, should lead to less confidence and lower investment levels. Perhaps, an explanation could be that inflation over the last two decades has been low in the EM countries we analyzed, and the evidence tends to suggest that the negative impact of inflation on growth occurs once inflation is above a certain threshold, typically above 20 percent or so. Common law, as proxied by UK legal origin, is also insignificant. This suggests that legal origin is not a major determinant of crisis.

Rising US nominal interest rates increase the probability of a crisis. The coefficient of US nominal interest rates is positive and significant at 5 percent, suggesting that rising US interest rates increase the probability of a crisis. Rising US interest rates make domestic EM assets less attractive, leading to a reallocation of assets overseas. Capital outflow, if it accelerates, can

then enhance the likelihood of a crisis.

Government debt level, external debt ratio, and government revenue have no clear impact on the probability of a crisis. This is not surprising. Although a government with a lower debt should, in principle, be less likely to have a crisis, we know that government debt levels were at very different levels during the EM crisis. The explanation could be that the debt tolerance of each country differs, being high in some countries and low in others, which reflects credibility arising from a country's history of debt defaults (Reinhart, Rogoff, and Savastano (2003)). A change in government revenue does not have a significant impact on the probability of a crisis. This is not unexpected, because it is revenue and expenditure jointly that matter, rather than one or the other.

The purchase of domestic financial assets a proxy for financial integration with the world economy by foreigners increases the probability of a crisis. In Table 4.5, the connection between net positions in foreign and domestic assets is analyzed. The regression results show that only foreigners' holdings of domestic assets matter for the probability of a crisis occurring, and the coefficients are negative and significant at the 5 percent level, while ownership of foreign assets by domestic holders does not appear to matter in explaining crisis. The results imply that foreign investors raise the probability of crisis, since when they accumulate domestic assets, they effectively increase domestic asset shortages, raising pressure for even higher asset prices.

4.3.4 Current Account

In this section, an empirical estimation of the relationship between asset shortages and the current account balances is undertaken. Caballero, Farhi, and Gourinchas (2006) has argued that the current global imbalances reflect EMs' inability to produce safe assets. Chapter 2 argued that the existence of asymmetric financial markets can also lead to a rise in demand for asset at the same time a fall in asset supply in EMs. In other words, EMs are unable to generate enough assets to store their new-found wealth. On the other hand, advanced economies notably the US and UK are able to generate such assets easily, reflecting the strength of their capital markets. With increased liberalization of capital markets, asset shortages in EMs have spillover effects, with excess savings being channeled to overseas economies that are better able to generate financial assets. As we argued earlier in this chapter, at the micro

level, many private enterprises in EMs are credit constrained. To finance their future investment, instead of issuing financial assets to raise funds on capital markets, they have to raise financing through internal savings. The rapid growth of these self-financed firms, combined with the corresponding downsizing of banks and financial firms, creates an artificial lack of domestic investment opportunities for banks. As a consequence, a growing share of domestic savings has to be invested abroad, leading to a current account surplus (see also Song, Storesletten, and Zilibotti (2011)).

To avoid endogeneity problems, system-GMM is again used for the estimation. First difference is used, given evidence of unit roots. We test for unit roots in the current account balance using the Im, Pesaran, and Shin (2003) panel unit root test. Because the test suggests that the null hypothesis cannot be rejected, the current account balance contains a unit root. The null hypothesis in its first difference can be rejected (Table 4.9), leading to the use of change in the current account as the dependent variable.

The starting point is to regress the change in the current account balance on a set of core variables selected according to the literature, with additional regulation variables added separately. Moreover, by definition, the real economy factors that drive current account balances are orthogonal to the determinant of financial asset issuances; hence, by excluding the real side factors in our regression, the results will not be biased. The following regression is estimated:

$$\begin{aligned} \Delta CA_{it} &= \beta_1 \Delta CA_{it-1} + \beta_2 ASIndex_{it} + \beta_3 \Delta Inflation_{it} \\ &+ \beta_4 Openness_{it} + \beta_5 \Delta RealInterestRate_{it} \\ &+ \beta_6 REER_{it} + \beta_7 \Delta GovtFiscalBalance_{it} \\ &+ \beta_8 \Delta WorldGDPgrowth_{it} + \beta_9 X + \varepsilon_{it} \end{aligned} \tag{4.20}$$

The core regression includes the impact of change in the current account lagged by one period, the AS index, openness, change in inflation and real interest rate, real effective exchange rate (REER), change in government fiscal balance, and change in world GDP growth. Subsequent regressions include GDP per capita as a measure of the wealth of individuals, change in a country's credit rating, overseas investment restrictions, legal origin, US interest rate, crisis introduced as a dummy variable, exchange rate risk and term of trade.

Table 4.6: Estimating Changes in the Current Account Using System-GMM

	Δ Current Account Balance								
Independent.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ C.A.(t-1)	-0.025	-0.037	-0.029	-0.033	-0.025	-0.043	-0.015	-0.024	-0.021
	(0.107)	(0.124)	(0.111)	(0.114)	(0.107)	(0.106)	(0.108)	(0.106)	(0.105)
AS index	0.007**	0.006**	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**	0.007**
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)
Δ Inflation	0.013***	0.013***	0.013***	0.015***	0.014***	0.012***	0.014***	0.0149***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Openness	-0.00005**	-0.00008	-0.00004*	0.00001	-0.00005**	-0.00005**	-0.000001	0.00003	0.00001
	(0.00002)	(0.00005)	(0.00002)	(0.00004)	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)
Δ Real	0.001	0.001	0.001	0.001	0.00117	0.002	0.00109	0.001	0.001
interest	(0.001)	(0.001)	(0.001)	(0.001)	(0.0009)	(0.0008)	(0.00101)	(0.001)	(0.001)
REER	-0.000001***	0.000001***	0.000001***	-0.000001***	-0.000001***	-0.000001***	-0.000001***	-0.000001**	-0.000001**
	(0.0000004)	(0.0000004)	(0.0000004)	(0.0000004)	(0.0000004)	(0.0000004)	(0.0000004)	(0.0000004)	(0.0000004)
Δ Government	0.004*	0.005*	0.005*	0.005*	0.005*	0.005*	0.005*	0.005*	0.005*
fiscal balance	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Δ World GDP	0.080*	0.077*	0.082*	0.084*	0.080*	0.056	0.0695	0.090*	0.089*
growth	(0.044)	(0.042)	(0.045)	(0.045)	(0.0440)	(0.043)	(0.0458)	(0.046)	(0.045)
GDP per		0.0000004							
capita		(0.0000004)							
Δ Countrys			-0.009*						
credit rating			(0.005)						
Regulation				-0.008					
				(0.005)					
Common law					0.00237				
					(0.00356)				
Crisis dummy (t-1)						0.040***			
						(0.012)			
US interest rate							-0.002		
							(0.001)		
Ex. rate risk								-0.001**	
								(0.0004)	
Term of trade									-0.0001*
									(0.00003)
Arellano-Bond test	0.070	0.070	0.090	0.070	0.070	0.070	0.077	0.070	0.070
for AR(2) in first diff									
Hansen test of overide	0.98	0.99	0.96	0.96	0.96	0.96	0.96	0.96	0.96
restrictions									

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

The impact of asset shortages on the current account is positive and statistically significant (see Table 4.6). This is consistent with our analysis that EMs' inability to generate enough financial assets relative to domestic savings leads them to invest in overseas financial assets. The export of capital results in a current account surplus. This finding is robust to different specifications and inclusion of different explanatory variables. The finding empirically supports the idea advanced in Chapter 2 as well as Caballero, Farhi, and Gourinchas (2006), though the latter's focus mainly is on asset shortages for safe assets, whereas our analysis argues that asset shortages in general, rather than just safe assets, are the problem. Other key results include:

- Inflation and improvements in the fiscal balance have a positive and statistically significant effect on the current account balance. A higher inflation rate in the economy has a negative income effect on households, decreasing domestic consumption and reducing imports. Moreover, rising inflation tends to lead to higher uncertainty, which again dampens investment. Similarly, improving government balances, either via higher taxes or lower expenditure, reduces aggregate demand and imports, thereby improving the current account.

- The real exchange rate has, as expected, a negative and statistically significant effect on the current account balance. A depreciating currency makes local goods more attractive in overseas markets, while rendering imported goods more expensive in the domestic economy, thereby helping to improve the current account.

- A change in the real interest rate does not have a statistically significant impact on changes in the current account. This could be a reflection of imperfectly functioning financial markets, with the interest rate channel not acting as an equilibrating mechanism between savings and investments. Moreover, capital flow might be driven by more than simply interest rates.

- Our results confirm that growing world GDP improves the current account. A flourishing world economy, proxied by changes in world GDP growth, should spur exports, thereby improving the current account.

- GDP per capita has an insignificant impact on changes in the current account. We would have expected the coefficient to be statistically significant, because all else being equal, poorer economies need more

investment, which is likely to be financed by borrowing externally. As capital markets are imperfect, however, this relationship may not hold.

- Capital account openness has a statistically significant and negative relationship to changes in the current account balance. As EMs are experiencing asset shortages, the excess savings will flow into overseas asset markets if restrictions on investing overseas are low, but stay in the domestic markets if these restrictions are high.

- A change in a country's credit rating has a statistically significant and negative impact on the current account balance. Because a credit rating is associated with improved growth prospects and higher tolerance for debt and shocks in general, this relationship is to be expected. As a country moves up the rating ladder, it attracts more capital inflow from the rest of the world, shrinking the capital account balance and thereby raising the current account balance.

- Overseas investment restrictions (Regulation) do not have a statistical significant impact on the current account, although the sign is as expected. The institutional restriction variable is a dummy variable, taking the value of 1 if the restriction on institutional investors exists, and 0 otherwise. We argue that restrictions on how institutional investors can invest overseas will reduce capital outflow and hence reduce the current account. Perhaps, in many EMs, the institutional restriction variable is not binding. Alternatively, our variable is too crude.

- Legal origin does not affect the current account. Legal origin is in principle an important indicator affecting the macroeconomic environment, as pointed out by numerous studies (e.g., La Porta, Lopez-de Silanes, Shleifer, and Vishny (1998)). According to this literature, common law is more creditor friendly than civil law, and hence more dynamic and conducive to investment. We do not find such a relationship. First, the variable might be too crude, and ignore the indirect ways through which institutional factors could affect changes in the current account (e.g., asset shortages, interest rates, inflation). Second, legal origin is a variable that does not vary much over time, which can again explain its lack of significance.

- US nominal interest rates do not have a significant negative effect on the current account. This could reflect a lack of financial integration with

the US, such that the capital flows do not respond to changes in US interest rates. At the same time, there might be high transaction costs or other market imperfections that make capital inflows insensitive to US interest rates.

- Exchange rate risk has a negative impact on the current account balance. This is consistent with the finding that as exchange rate volatility increases, risk averse investors get more cautious. Import and export activities decline, and in extreme cases, the world 'deglobalizes' and the current account closes.

- Crises, as expected, have a positive and statistically significant impact on the current account. Crisis leads to a compression of domestic demand, and hence imports.

- Terms of trade improvements have a positive impact on the current account. An improvement in the terms of trade means a country has to pay less per unit of imports it receives and therefore is positively correlated with changes in the current account.

In sum, our evidence shows that asset shortages lead to current account surpluses. One way for EMs to address the current account surpluses is to increase the supply of financial assets, through improving economic fundamentals further and improving the domestic investment environment, for instance.

4.4 Conclusion and Policy Implications

We started the chapter by modeling and calibrating the impact of asset shortages in EMs. The implications of the model were as follows: First, we found that asset shortages have a negative impact on economic growth. Second, asset shortages are a significant source of asset bubbles over time and thereby increase the probability of a crisis. Last, asset shortages are a leading explanatory variable in current account surpluses of emerging markets. The macroeconomic implications are grave, and must be addressed to avoid macroeconomic instability going forward.

Asset shortages are not only dangerous for the macroeconomic stability of EMs, but are also a cause of the present global imbalances. Shortages of financial assets in EMs generate permanent current account surpluses, which are clearly not sustainable. Eventually, for creditors to repay their debt, they

will either have to generate current account surpluses, or the assets owned by EMs in AEs will have to fall in value (through exchange rate adjustment for instance).

Given the danger that asset shortages pose for EMs and global stability more generally, it is crucial for policy makers to tackle the problem sooner rather than later. The arguments do not apply just to EMs, but even more so to frontier market - the subset of emerging markets with small and illiquid market capitalizations - because the consequences of asset shortages are particularly strong there.

Measures that would help reduce asset shortages include the following (see Chapter 3, for other policies to address the asset shortage imbalances.):

- Correcting asymmetric financial markets. It is crucial for the policy makers to stop favoring or discriminating a certain set of firms in accessing credit markets, furthermore to avoid the un-intended consequences on financial markets when implementing policies (see Chapter 2 for a detailed discussion).
- Deepening of domestic capital markets. It is essential that efforts be made to deepen capital markets so as to provide a wider range of assets for investment.
- Encouraging more domestic companies to list on the domestic stock market and privatizing public corporations. In many EMs, tax reasons and a judicial environment that is cumbersome and unpredictable act as restraints on listing domestically. This would also improve financial intermediation, thereby raising growth.
- Providing support for money to flow out. This can be achieved through reducing the foreign investment restrictions for institutional investors.

Developing capital markets is however, a double edge sword, and may initially worsen, rather than improve the asset shortage problem. By deepening capital markets, more capital may flow in for instance relative to the new asset being created, while monetary policy may become less effective, and more unpredictable. Therefore, EMs may have to live with the consequences of asset shortages, and the resulting risk to the economy, for the foreseeable future. Policy makers should therefore strengthen buffers to increase the resilience of the financial system simultaneously.

4.A Appendix

4.A.1 Tables

Table 4.7: Panel Unit Root Test 1995 - 2008 I

	Test Statistics	
	Levels	Differences
GDP Growth	-1.565	-2.073***
AS Index	-1.603	-1.961***

*** Significant at 1 percent. Null hypothesis: there is a unit root.

Table 4.8: Panel Unit Root Test 1995 - 2008 II

	Test Statistics	
	Levels	Differences
Asset Bubble Index	-1.268	-2.020***

*** Significant at 1 percent. Null hypothesis: there is a unit root.

Table 4.9: Panel Unit Root Test for 1995 - 2008 III

	Test Statistics	
	Levels	First differences
Current Account Balance	-1.308	-2.260***

*** Significant at 1 percent. Null hypothesis: there is a unit root.

4.A.2 Data

Table 4.10: Country Classifications

Latin America	East Asia
Argentina	China, PR
Brazil	China, Hong Kong
Chile	India
Colombia	Indonesia
Mexico	Korea, Republic of
Panama	Malaysia
Peru	Philippines
Venezuela Rep.	Taiwan
	Thailand
	Vietnam
Middle East/South Africa	**East Europe**
Bahrain	Bulgaria
Egypt	Croatia
Israel	Czech Republic
Kazakhstan	Hungary
Kuwait	Latvia
Morocco	Lithuania
Pakistan	Poland
Saudi Arabia	Romania
South Africa	Russia Federation
Turkey	Slovak Republic
UAE	Slovenia
	Ukraine

Table 4.11: Data Description I

Series	Name	Description Source
Gross Domestic Product (current US dollars)	Gross domestic product at current price in US dollars. GDP data is converted from domestic currencies using yearly average official exchange rates.	IMF: World Economics Outlook; World Bank: World Development Indicators
Gross Domestic Product per Capita (current US dollars)	GDP divided by total population.	IMF: World Economics Outlook; World Bank: World Development Indicators
Gross Domestic Saving	Defined as Gross National Disposable Income subtracts Total Expenditures. Data is converted from domestic currencies using yearly average official exchange rates.	IMF: International Financial Statistics, World Economic Outlook; World Bank: World Development Indicators
Bond Issuance in Domestic (Foreign) Market	Data is converted from domestic currencies using yearly average official exchange.	Dealogic
Loan Issuance in Domestic (Foreign) Market	Data is converted from domestic currencies using yearly average official exchange.	Dealogic, Bankscope
Equity Issuance in Domestic (Foreign) Market	Data is converted from domestic currencies using yearly average official exchange.	Dealogic
Short Term Deposits	Data is converted from domestic currencies using yearly average official exchange.	Bankscope
Inflation	Inflation as measured by the log annual growth rate of the gross domestic product implicit deflator. We use the CPI if the GDP-deflator is not available.	IMF: World Economics Outlook; World Bank: World Development Indicators

Table 4.12: Data Description II

Series	Name	Description Source
Net position of Foreign holding of Domestic Assets	Foreigner's asset minus liabilities positions in domestic debt, equity, other investable assets and other investments.	IMF: Balance of Payments
Net position of Domestic holding of Foreign Assets	Domestic investor's asset minus liabilities positions in foreign debt, equity, other investable assets and other investments.	IMF: Balance of Payments
Real interest Rate	Nominal interest rate taken away inflation.	World Bank: World Development Indicators
Fiscal Deficit	The overall budget is total expenditure and lending minus repayments less current and capital revenue and official grant received; shown as percentage of GDP. Data available for central government only.	Haver Analytics
Real Exchange Rate (REER)	Number of foreign currency per 1 domestic currency.	IMF: International Financial Statistics
Institutional Regulation	Constructed from AREAER's provisions specific to institutional investors (including: Insurance companies, Pension funds, Investment firms and collective, excluding banks). The restriction is on holding of both domestic and foreign assets. Due to data availability and changing format of the report over the period we are interested, the outcome is a binary number, 1 = restriction exist, otherwise it is 0.	IMF: Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)
World GDP	The IMF revised the reporting format for capital account restrictions in 1996, when it started to provide more details on aspects of capital account liberalization. Before 1996, the IMF measure of capital account liberalization is a simple dummy variable.	World Bank: World Development Indicators
Degree of Capital Account Openness (Kaopen)	Constructed base on the four binary dummy variables: 1, presence of multiple exchange rates; 2, restrictions on current account transactions; 3, restrictions on capital account transactions and 4, requirement of the surrender of export proceeds reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). These variables are to provide information on the extent and nature of the restrictions on external accounts. Higher the number means more capital account openness.	Chinn and Ito (2005)
de facto Exchange Rate	The number ranging from 1 - 6, 1 meaning de facto peg.	Reinhart and Rogoff (2004)

Table 4.13: Data Description III

Series	Name	Description Source
Institutionalized Democracy Democracy	is conceived as three elements. 1, the presence of institutions and procedures through which citizens can express effective preference about alternative policies and leaders. 2, the existence of institutionalized constraints on the exercise of power by the executive. 3, the guarantee of civil liberties to all citizens in their daily lives and in acts of political participations. The indicator is an additive eleven-point scale (0-10)	Policy IV project - University of Maryland
Education Attainment (Secondary)	Set of Panel data recording the education attainment in 146 countries from 1950 to 2010.	Barro and Lee 2010
Trade Openness (Total Trade)	Sum of imports and exports of goods and services over GDP.	IMF: Balance of Payments
Government Fiscal Balance		IMF: Government Finance Statistics, Staff Report; Haver Analytics
External Debt		IMF: International Financial Statistics; Staff Report
Government Debt		IMF: Government Finance Statistics, Staff Report
Government Revenue		IMF: Government Finance Statistics, Staff Report
Country Credit Rating	Short term Credit Rating for each country we are interested over 1990 - 2009.	Fitch
Government Stability	ICRG political risk sub-component (12 percent) weight. This is a measure both of the government's ability to carry out its declared program(s), and its ability to stay in office. This will depend on the type of governance, the cohesion of the government and governing party or parties, the closeness of the next election, the government's command of the legislature, and popular approval of government policies.	Political Risk Services: International Country Risk Guide.

Table 4.14: Data Description IV

Series	Name	Description Source
Economic Risk Rating	The value of the Political Risk Service (PRS) Group's economic risk indicator (which ranges between 0 and 50). The risk rating is a combination of 5 subcomponents: GDP levels and growth, respectively, inflation, balanced budgets, and the current account. The minimum number of points for each component is zero, while the maximum number of points depends on the fixed weight that component is given in the overall economic risk assessment.	Political Risk Services: International Country Risk Guide.
Corruption	ICRG political risk sub-component (6 percent) weight. This is a measure of corruption within the political system. Such corruption: distorts the economic and financial environment, reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability, and introduces an inherent instability into the political process. The most common form of corruption met directly by business is financial corruption in the form of demands for special payments and bribes connected with import and export licenses, exchange controls, tax assessments, police protection, or loans. Although the PRS measure takes such corruption into account, it is more concerned with actual or potential corruption in the form of excessive patronage, nepotism, job reservations, "favor-for-favors," secret party funding, and suspiciously close ties between politics and business. In PRS's view these sort of corruption pose risk to foreign business, potentially leading to popular discontent, unrealistic and inefficient controls on the state economy, and encourage the development of the black market.	Political Risk Services: International Country Risk Guide.
Crisis	1 indicates the date of the crisis started; the dataset covers the universe of systemic banking crises for the period 1970-2007.	Laeven and Valencia (2008)
Law and Order	ICRG political risk sub-component (6 percent) weight. PRS assess Law and Order separately, with each sub-component comprising zero to three points. The Law sub-component is an assessment of the strength and impartiality of the legal system, while the Order sub-component is an assessment of popular observance of the law. Thus, a country can enjoy a high rating (3.0) in terms of its judicial system, but a low rating (1.0) if the law is ignored for a political aim.	Political Risk Services: International Country Risk Guide.
Risk for Exchange Rate Stability	Ranging from high percentage change of either 0.0 - 9.9 appreciation or depreciation of 0.1 - 4.9 with risk points at 10.0, to a midpoint of either appreciation at 50.0+ or depreciation of 30.0 - 34.9 with risk points at 5.0 to a low depreciation of 100.0+ with 0.0 points. The higher the points, the lower the risk. (Refer to ICRG Methodology for maximum points for this variable, as well as for related formulas for calculating risk.)	Political Risk Services: International Country Risk Guide.

Table 4.15: Data Description V

Series	Name	Description Source
Risk for Inflation	Ranging from high percentage of 130+ with risk points at 0.0, to a low of 0.0 with 10.0 points. The higher the points, the lower the risk. (Refer to ICRG Methodology for maximum points for this variable, as well as for related formulas for calculating risk.)	Political Risk Services: International Country Risk Guide.
Business Freedom	Business Freedom is a quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation, as well as the efficiency of government in the regulatory process. The business freedom score for each country is a number between 0 and 100, with 100 equaling the freest business environment. The Score is based on 10 factors, using data from the World Bank's Doing Business study.	The Heritage Foundation
Financial Freedom	Financial freedom is a measure of banking security as well as a measure of independence from government control. State ownership of banks and other financial institutions is an inefficient burden that reduces competition and generally lowers the level of available services. It has scale between 0 to 100, 100 means negligible government influence.	The Heritage Foundation
Property Rights	Property rights component is an assessment of the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state. It measures the degree to which a country's law protect private property rights and the degree to which its government enforces those laws. It also assesses the likelihood that private property will be expropriated and analyzes the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts. It has scale between 0 and 100, 100 means Private property is guaranteed by the government.	The Heritage Foundation
Local Sovereign Yield		Haver Analytics
External Sovereign Credit		EMBIC Spread
Price to Rent Ratio		Global Property Indicator
Price and Earning Ratio		Bloomberg; IBES
Commodity Prices Index	The index is constructed using a set of weighted commodity prices, ranging from Petroleum, Natural gas; Copper, Aluminum to Food prices.	IMF Commodity Index

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