LUND UNIVERSITY
School of Economics and Management

Master Programme in International Economics with a Focus on China

The Long-run Relationship between Savings and Investment in Transition Economies: Empirical Evidence from China

Richlove Mensah
richlove.mensah.223@student.lu.se

Abstract:

This study examines the underlying patterns of savings and investments in China for the period 1978 – 2008. The institutional changes that occurred as a result of the 1978 economic reforms programme brought about profound changes to the characteristics of savings and investments in China. The paper finds that household savings while high, do not explain China's high savings rate as a whole. High savings by enterprises and the central government has been the driving force behind China's high savings rate. Investment on the other hand is primarily financed by enterprise savings with FDI playing a relatively modest role. Using data from the World Bank, the study also revisits the savings and investment nexus as postulated by Feldstein and Horioka (1980). Among the key results, it is found that savings and investment cointegrated in China for the period 1978 – 2008 but the direction of causality between the two variables is not clear. There is strong evidence of causality in both directions.

Key words: Savings, investment, China, institutions, economic reforms, cointegration, Feldstein and Horioka puzzle, capital mobility.

EKHR71
Master thesis (15 credits ECTS)
August 2012
Supervisor: Tobias Axelsson
Examiner: Christer Gunnarsson

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AR	Autoregressive
FDI	Foreign Direct Investment
FH	Feldstein and Horioka
FIE	Foreign-Invested Enterprise
GDF	Global Development Finance
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GNP	Gross National Product
NDRC	National Development and Reform Commission
OECD	Organisation for Economic Co-operation and Development
SOE	State-Owned Enterprise
TVE	Township and Village Enterprise
VAR	Vector Autoregressive
VEC	Vector Error Correction
WDI	World Development Indicators

INTRODUCTION

Historically, the rate of savings in China has been higher than those of the US and Western Europe. With China's continued economic ascendency, questions on how China manages its savings and investment arouse interests from policy makers and academics alike. The Chinese government's response to the recent global financial and economic crisis – a RMB 4 trillion investment stimulus package – was widely analysed by Western economists and policy makers. However, knowledge about the underlying patterns of savings and domestic investment in China is very limited. Given the recent financial crisis, the current fragility of banks and the retrenchment of international capital flows, it is imperative to critically review the existing empirical literature on the relationship between savings and investment to ensure that policy makers are well informed. The objective of this thesis is to describe, model and estimate the relationship between savings and domestic investment in China since reforms began in 1978. The thesis aims to address two distinct research questions so it will be organised into two distinct but complementary parts. Part I looks at the **institutional factors** that drives China's savings and domestic investments and Part II estimates the **long-run relationship** between savings and investments for the period 1978 – 2008. The first specific question that this study endeavours to answer can be summarised as follows: How has China generated such high levels of both savings and investment? By asking this question, the objective is to provide a detailed analysis of the determinants of savings and investment in post 1978 China. The general questions on why and how are discussed but throughout the first part of the paper, particular emphases will be placed on the institutionalisation of market reforms. Understanding the institutional factors that drives Chinese savings and investments can provide some critical information that can be utilised to assess the type of risks and policy challenges stemming from the high rates of savings and investment. The second specific question addressed by this study asks whether there is a long-run relationship between Chinese savings and domestic investment. The paper uses data from the World Bank to address this crucial question. The econometric methodology employed for this part of the study is the Engle and Granger approach. Examining the determinants of savings and investment in China and the long-run relationship between the two variables can assist policy makers in making some key macroeconomic decisions. According to the most recent Five Year Plan (the Twelfth Guildeline, 2011 – 2015), one of the key priorities of the Chinese government is sustainable economic growth so understanding the relationship between savings and investment and ultimately economic growth can only be beneficial. Some

empirical literature has explored the relationship between savings and investments for many developed countries ((Feldstein and Horioka, 1980; Maddison, 1992; Lemman and Eijffinger, 1995; Coakley and Kulasi, 1997). Nonetheless, to the best of my knowledge, few studies have focused on transition countries, with the notable exception of Narayan (2005) which addresses the cointegration of savings and investment in China. Using data obtained from the *Comprehensive Statistical Data and Materials on 50 Years of New China*, Narayan finds cointegration of savings and investment for the period 1952 – 1998. According to the seminal work of Feldstein and Horioka, these results can be interpreted as evidence of low capital mobility between China and the global economy. As already stated, the second part of the thesis attempts to re-examine the Chinese evidence over the past three decades. Compared to the study of Narayan (2005), the present paper has two major distinguishing features. First, it attempts to explain how and why China has had such high savings and investment rates based on institutional factors. Particular emphasis is placed on the communist legacy, the role of economic decentralisation and the institutionalisation of market reforms. Secondly, the thesis concludes that although there is evidence of cointegration, the direction of causality between the two variables is not very clear.

The rest of the paper is organised as follows. Chapter I of the paper will analyse the evolution of savings since reforms began. How were savings generated during this crucial period? What role did the government, corporations and households play in the accumulation of savings? This discussion leads to the examination of the paradox between urban and rural households savings. The 1980s saw a marked shift towards a high savings regime in China, similar to that of Japan and South Korea (Naughton, 1986). This shift can be attributed to the remarkable institutional changes which transformed both the urban and rural areas. The institutionalisation of market reforms meant that urban households had to save more to offset the rising cost of housing and education, inadequate pension and the uncertainty of future earnings (Qi, 2000; Yu, 2003; Shi and Zhu, 2004). For rural households, the Household Responsibility System transformed the agrarian economy and brought about variability of income and high levels of savings. The discussion of the paradox of household savings also leads to the examination of the theory of forced savings. As with other planned economies, the persistent shortage of consumer goods may have forced some households to save what they otherwise may have wished to spend in the absence of shortages. I do however conclude that forced savings may provide just a partial explanation for China's high savings rate because in broad terms the shortage of various consumer goods cannot lead to forced savings.

It can be expected that households may substitute other commodities for unavailable consumer goods and hold precautionary stocks in both currency and commodities.

Chapter II discusses the rates of investment in China since reforms began. The discussion of the substantive factors concerning investment focuses on the institutional and economic factors which determined the behaviour of planners and decision makers at the central and local levels. I discuss the problem of investment fluctuations as postulated by the *Bauer-Kornai Investment Cycle Theory*. In their seminal work, Bauer (1978) and Kornai (1980, 1986) postulated that economic planners in centrally planned economies adjust the rate of investment according to the *shortage intensity* in the economy. When shortage is below or around the normal rate, economic planners approve and initiate a large number of investment projects. The resulting overinvestment will eventually overheat the economy so in response, the authorities will halt all new investment and cut or even stop some existing ones to restore some balance until a new cycle starts again. There are some elements of this theory that correspond to the workings of the Chinese economy but it may not be totally applicable because Chinese fiscal federalism and economic decentralisation means that the central government do not have the total control of most regional investment projects. I describe the configurations of Chinese investment cycles, based on this theory and unique Chinese characteristics.

Chapter III links Chapters I and II by setting out the theoretical framework about the relationship between savings and investment. This line of thought is developed by analysing both the classical and Keynesian approach to savings and investments. In addition, the savings and investment nexus as postulated by Feldstein and Horioka (FH puzzle) (1980) is revisited. The explication and application of the theoretical framework provides the focus to the subsequent steps in carrying out the empirical examination of the relationship between savings and investments.

The concept of cointegration is employed in Chapter IV to estimate the long-run relationship between savings and investments for the period 1978 – 2008 so the chapter is devoted to descriptive and empirical work. The first section states the hypothesis and the model for the empirical examination, followed by the description of the data series and the methodology employed for the study. Chapter V presents the empirical results of the cointegration test. As already stated, the result of the empirical tests indicates that savings and investment

cointegrated in China for the period 1978 – 2008 but the direction of causality is not very clear. The final chapter, Chapter VI is divided into three sections. A summary is presented in the first section, the second section elaborates the conclusions of the study and policy implications and recommendations are given in the final section of the chapter. Chapters I and II therefore provides a detailed analysis of the sources of, and factors behind China's savings and investment rates and as such, they help address the first research question. Similarly, Chapters III, IV and V provide both the theoretical basis and the empirical estimation of the long-run relationship between savings and domestic investment so they help address the second research question.

The preliminary analysis of the processes at work in the Chinese economy presented in this thesis is an illustration of the fundamental distinctive characteristics of China's growing economy. However, the interpretation presented in this thesis is far from complete. The most striking shortcoming is the almost total lack of analysis of the production characteristics of the Chinese economy which is beyond the scope of the present paper. By focusing primarily on the relationship between savings and investment, the analysis in this paper captures some important elements of the processes by which certain outcomes are derived but it conveys very little about these outcomes. The paper however provides a firmer understanding of the institutional characteristics of the Chinese economy.

PART I

THE INSTITUTIONAL DETERMINANTS OF SAVINGS AND INVESTMENTS

CHAPTER I – SAVINGS

Much attention has been directed towards China's high savings rates in recent years (Kraay, 2000, Kuijs, 2005, He and Cao, 2007, Chamon and Prasad, 2008). Not only has the rates of savings in China been historically high compared to other leading economies but it has in fact risen significantly in the last 30 years. Structural forces, including policies associated with rapid economic growth, corporate restructuring and the response by households and the government to institutional changes provides some explanation for this phenomenon.

Defining savings

A substantial literature exists on the different types of savings, including national savings, household savings and household demand deposits. It is imperative however to define the type of savings referred to in the present paper. According to the national accounting system (UN, 1995; Barro, 2009) gross domestic savings is the total national disposable income after final consumption expenditure (total consumption). National disposable income is GDP plus net factor income and net transfers from abroad whereas national consumption can be disaggregated into household consumption, business consumption and government consumption (Barro, 2009:17). Thus, national savings equates to disposable national income excluding national consumption. The present paper uses gross domestic savings which constitutes household savings, business savings and government savings.

Understanding China's high savings rate

The high savings rate in China has been widely attributed to China's underdeveloped financial market (Liu and Woo, 1994; Chamon and Prasad, 2008; Ma and Yi, 2010) and Chinese culture (Yusuf, 1994; Kraay, 2000; Harbaugh, 2004). The underlying pattern of how China generates such high savings is however less understood. To better understand the sources of and factors behind China's savings rate, it is useful to examine the breakdown of China's gross national savings by its components: household, corporate and government savings. The existence of different economic systems in urban and rural areas has played an important part in the accumulation of savings (Cao and He, 2007). The savings rate for both urban and rural households has risen significantly since economic reforms began in 1978. For

urban households, savings grew from 9% in 1978 to 24% in 2004 (Cao and He, 2007). This marked increase was largely due to precautionary savings. The inadequate pension system (West, 1999; Leung, 2003), the increasing cost of education (Tsang, 1994; Brown and Park, 2002) and the government's housing system reforms (Wang, 2000; Wang, 2001) all contributed to the rise in savings by urban households. In contrast the marked rise in rural household savings which grew from 13% in 1978 to 26% in 2004 was largely due to the implementation of the Household Responsibility System[1]. This institutional change which replaced the production team system as a unit of production and income distribution resulted in a remarkable growth in rural household's income (Lin, 1988). The establishment of a market pricing system for agricultural products benefited rural households enormously. Their income grew very quickly but their consumption remained low. At the same time, the reform of state-owned enterprises led to increasing profitability and savings, particularly for non-financial corporations (Cao and He, 2007). In addition, government savings also increased dramatically due to institutional reforms. The reform of the bureaucracy led to a significant decline in the number of government officials, leading to a reduction in government consumption (Li, 1998). The reform of the bureaucracy also coincided with increasing tax revenue. Tax revenue as a percentage of GDP rose from 4% in 1994 to 10% in 2008 (World Bank Data). Consequently, the government's share of savings in the gross national savings (as a percentage of GDP) increased from 4.4% in 1992 to 11% in 2008 (Ma and Yi, 2010). The composition of China's gross national savings from 1992 to 2008 is presented in Table 1.

[1]Lin Justin Yifu's seminal paper "The Household Responsibility System in China's Agricultural Reform: A Theoretical and Empirical Study" provides a comprehensive analysis of the Household Responsibility System.

Table 1: **Composition of China's national gross saving, 1992 - 2008**

As a percentage of GDP

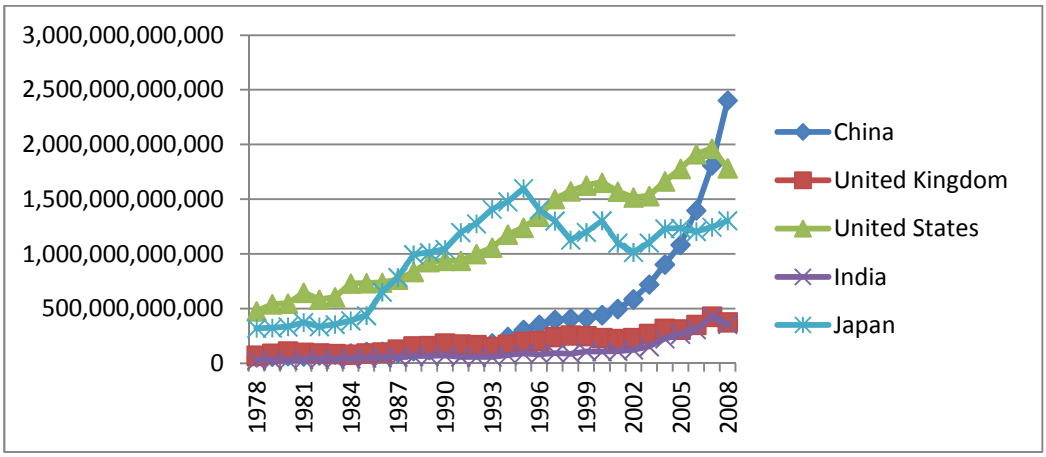
Year	Total	Households	Corporate	Government
1992	36.4	20.3	11.7	4.4
1993	38.0	18.2	15.7	4.1
1994	39.4	21.7	14.5	3.2
1995	38.1	19.6	16.0	2.5
1996	37.1	19.9	13.5	3.7
1997	38.4	21.4	13.0	4.0
1998	37.7	21.1	13.3	3.3
1999	37.1	19.9	14.6	2.6
2000	37.3	17.5	16.5	3.3
2001	38.2	16.6	17.4	4.2
2002	40.3	17.2	18.0	5.1
2003	43.6	18.3	18.3	7.0
2004	46.6	18.5	23.5	4.6
2005	48.2	21.5	20.4	6.4
2006	49.5	21.7	18.8	8.9
2007	51.8	22.2	18.8	10.8
2008	53.2	23.4	18.8	11.0

Source: Guonan Ma and Wang Yi, "China's High Savings Rate: Myth and Reality" *BIS Working Paper No 312,* June 2010. Page 11

International comparisons with Chinese savings

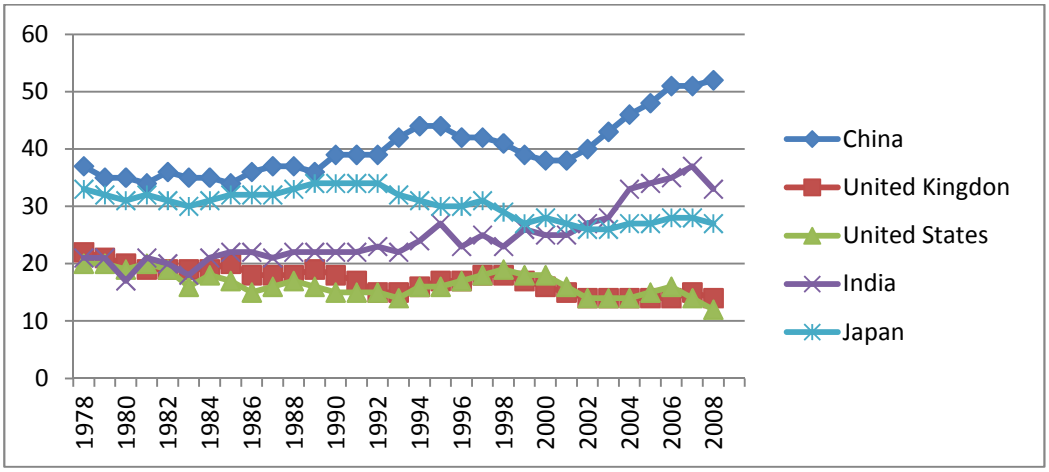
The significant rise in Chinese savings since reforms began cannot be overemphasised. Figure 1 illustrates that China's gross domestic savings in 1978 was just over $55bn compared to $475bn for the United States (the highest saver) but by 2008 China's savings rate had increased by almost 400% to $2.4 trillion making China the highest saver amongst the five countries. In the same period, the United States and Japan managed to increase their savings rate by only 38% and 41% respectively. More remarkably, China's savings rate in 1978 was more than double the rate of India, a fellow developing country in Asia. This remarkable difference in the rate of savings between China and India has persisted throughout the observed years (refer to Appendix III). It can also be shown in Figure 2 that China's gross domestic savings as a percentage of GDP has consistently been the highest amongst the five countries, reaching over 53% in 2008. Before reforms began, China's high savings rate which averaged around 27% of GNP was engineered by the state (Kraay, 2000). Household income was very low – per capita GDP was around $183 (Nabeshima, Perkins and Yusuf 2006:3) so households accounted for a very small portion of total savings. Distorted relative prices for many goods and services favoured industry and this led to a massive concentration of profits in China's state-owned enterprises (SOEs). The state directed these profits to its investment priorities, namely the promotion of heavy industries. However the Chinese economic reform has led to the transformation of the roles played by public and private sectors in terms of savings (Kraay, 2000). Price reforms and vigorous competition from collectively-owned enterprises such as the Township and Village Enterprises (TVEs) have significantly curbed the operating surpluses of state-owned enterprises and consequently the importance of public savings. Rising household income – per capita GDP rose from $183 in 1978 to $5,184 in 2011 (IMF, 2011) and rising private savings have elevated the status of household savings.

Figure 1: Gross Domestic Savings (in current US $) for China, United Kingdom, United States, India and Japan, 1978 – 2008.



Source: World Bank National Accounts Data, and OECD National Accounts Data Files

Figure 2: Gross Domestic Savings (% of GDP) for China, United Kingdom, United States, India and Japan, 1978 – 2008.

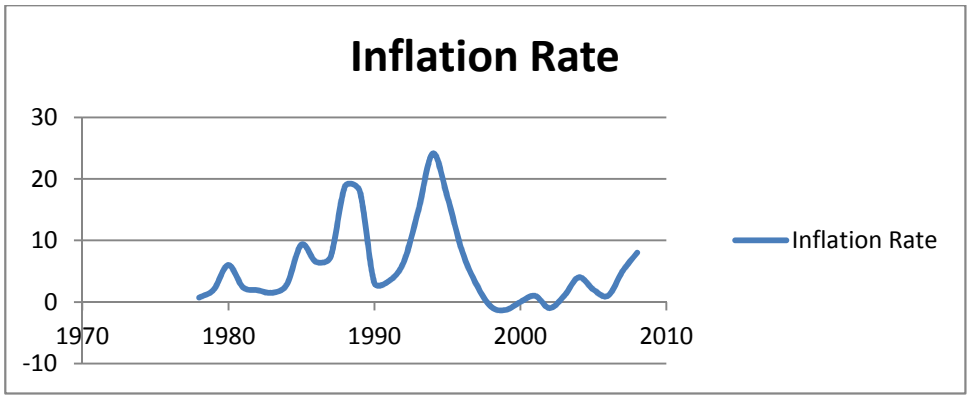


Source: World Bank National Accounts Data, and OECD National Accounts Data Files

Forced savings

One of the key problems faced by economic planners in centrally planned economies is how to coordinate the growth in money supply with a controlled price system (Feltenstein and Ha, 1993). This problem is further compounded by the unavailability of a foreign sector and a distorted exchange rate regime. Consequently if changes in money supply are not accompanied by changes in domestic prices and exchange rate, demand will be invariably repressed. It is possible that prices, which are subject to numerous controls, will lag behind the growth of money sufficiently so as to create at least excess nominal demand for consumer goods which are often subject to shortages (Feltenstein and Ha, 1993). As a result, the excess monetary expansion thus forces savings. Before 1978, the recorded rate of inflation in China as measured by the official price indices was extremely low (Brandt and Zhu, 2000). Between 1952 and 1974, the retail price index which was largely the measure of the price prevailing in official markets remained largely unchanged (Tsakok, 1979) indicating that inflation was somehow been repressed. The repression of inflation continued through the early years of reform. The liberalisation of the economy created certain imbalances that led to more repressed inflation. Under the new institutional reforms, banks were permitted to expand credit as their deposits soared (Feltenstein and Ha, 1991). State-owned enterprises were no longer required to pay 100% profit tax so they too were able to retain large profits. The corresponding monetisation led to a rapid growth in money supply. At the same time, the price level of consumer goods hardly grew in comparison with other indices (Feltenstein and Ha, 1991). The growth in money supply was therefore more rapid than the nominal value of retail sales thereby forcing households to save. However, the forced savings hypothesis does not fully explain China's high savings rate because it can be expected that households been rational, will adopt a variety of defensive strategies, including substituting other products for unavailable goods and holding precautionary stock in both currency and commodities. Moreover, inflation began to rise at an unprecedented rate after 1987, reaching 18.8% in 1988 and 24.1% in 1994. This can be illustrated in Figure 3. It is possible that the consumer demand for quasi-money balances (savings deposits) was the outcome of an anticipated inflation (Feltenstein and Ha, 1991). This was particularly true for urban households.

Figure 3: The Rate of Inflation in China, 1978 – 2008.



Source: World Bank and National Bureau of Statistics of China

The future of savings in China

With much of the increase in aggregate savings in China occurring after the turn of the century, the aggregate marginal propensity to save exceeded 50% by the end of 2007. Even more remarkable is the fact that the rising aggregate savings has been reflected in all three sectors – households, corporate and government. The analysis detailed above cast doubt on the proposition that repressed inflation and forced savings offer the main explanation for China's high savings rate. Instead, corporate restructuring (including pensions and home ownership reforms) and the institutionalisation of market reforms such as the Household Responsibility System have all played more important roles. The structural reforms suggests that China's savings rate will peak, at least in the medium term but shifting emphasis towards more domestic consumption would assist in reducing the high levels of savings. The next chapter, Chapter II looks at the evolution of China's high investment rates.

CHAPTER II – INVESTMENTS

The Chinese economy has witnessed high rates of investment over the past three decades, particularly in infrastructure and housing. Some scholars (Fan and Woo, 1996, He, Zhang and Shek, 2006, Qin and Song, 2007) argue that this high investment rates has had an adverse effect on economic growth and macroeconomic stability. The principal cause of the high rate of investment has been the weak constraints on enterprise investment expenditure and economic decentralisation. The 12th Five Year Plan is seeking to address this by shifting emphasis from investment to domestic consumption.

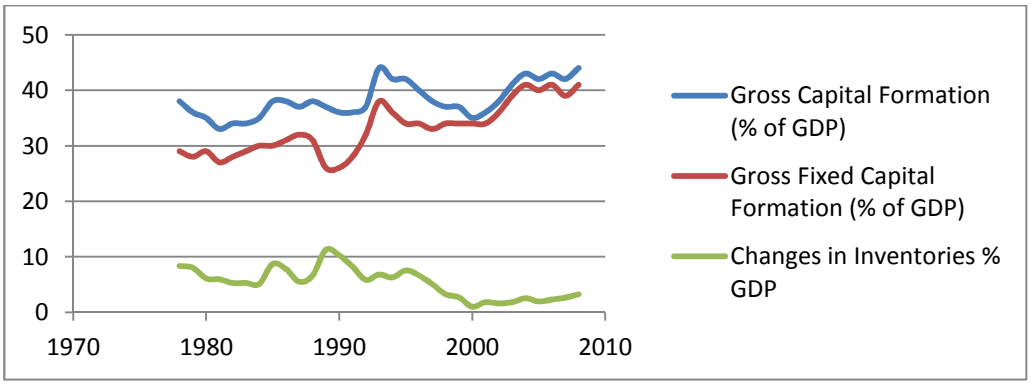
Defining investment

Investment in the present paper refers to Gross Fixed Capital Formation (GFCF). According to the United Nations' System of National Accounts (2008) GFCF is measured by the total value of a producers' acquisition, less disposals, of fixed assets during the accounting period plus certain specified expenditure on services that adds to the value of non-produced assets. GFCF is thus not a measure of total investment because only the value of net additions to fixed assets is measured. However, it is still the most reliable measure of investment because the GFCF of the business sector (non-financial and financial enterprises) is the largest single component of investment and its movement trigger off the beginning and end of economic cycles. It also determines the growth in apparent labour productivity (Blades and Lequiller, 2006).

Why do the Chinese invest so much?

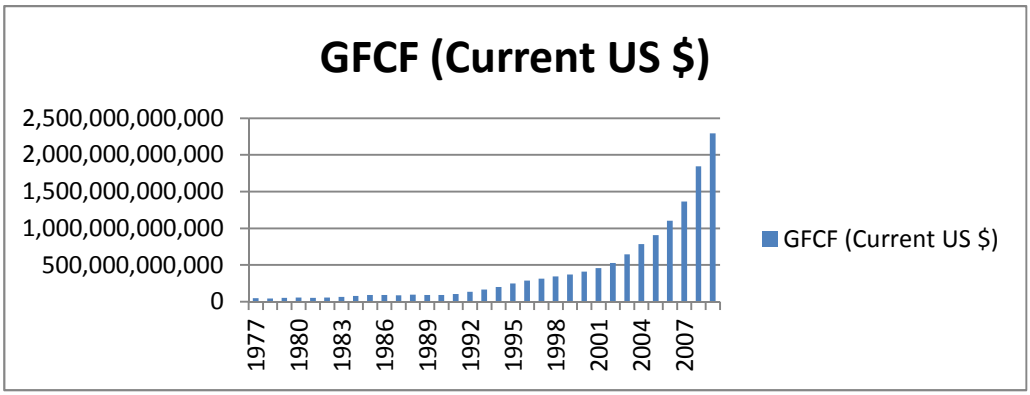
One of the outstanding features of the Chinese economy since reforms began has been the remarkably high rate of investment. Figure 5 illustrates the rates of investment over the last three decades. Between 1978 and 2008, GFCF grew at an average rate of 13%, peaking at 35% in 2008 (refer to Appendix II). Up until 2000, investment in inventories, (stocks of goods held by firms to meet temporary or unexpected fluctuations in future production or demand) was substantial. It reached a peak of 11% of GDP in 1989 as illustrated in Figure 4 but it declined gradually thereafter, owing to reforms away from the planned economy.

Figure 4: Gross Capital Formation and Its Composition, 1978 – 2008



Source: World Bank National Accounts Data

Figure 5: Gross Fixed Capital Formation, 1978 - 2008



Source: World Bank National Accounts Data

Investment booms

During the last three decades, three waves of investment booms have been observed. The first wave occurred in the mid 1980s when investment of rural surplus funds boosted the rapid development and expansion of township and village enterprises (TVEs). Deng Xiaoping's famous 'Southern Tour'[2] in 1992 triggered a second wave in the early 1990s and it was sustained throughout the 1990s despite the Asian financial crisis of 1997 (Barro, 2001). The most recent wave occurred in the early 2000s with China's accession to the WTO (Luo, Wang and Wu, 2009). This investment level is high by most standards, including when compared with countries with similar development strategy (relying heavily on exports), countries with similar income levels and the indeed the OECD.

[2] In the spring of 1992, Deng Xiaoping, the former leader of the Chinese Communist Party who was still regarded as the "paramount leader" of China, travelled around Guangzhou, Schenzhen and Zhuhai as a way of reasserting his liberal economic policies after his official retirement from office. Deng Xiaoping's insistence on economic liberalisation was the catalyst for the exceptional growth rates in coastal areas in the east and the south of the country.

The crucial role of enterprise investments

Enterprises account for the largest share of investments in China. Half of total fixed asset investment is financed from the internal funds of enterprises (Barnett and Brooks, 2006). These enterprises have large funds because the vast majority of them that are fully or partially owned by the state were not required to pay out any dividends before 2007 (Barnett and Brooks, 2006). Instead, they were allowed to reinvest their funds. Moreover, due to China's fiscal federal system, the zest for investment by various local governments has led them to undertake infrastructure spending through SOEs, funded by bank loans and capital transfers from the budget, enabling them to get around restrictions on direct borrowing (Barnett and Brooks, 2006). At the same time, the promulgation of the Company Law in 1993 which legalised private enterprises has led to a significant increase in fixed asset investment by private firms (Geng and N'Diaye, 2012). Around 32% of all enterprise investment goes into manufacturing, 23% into real estate whilst the other 45% goes into other sectors of the economy with the transportation and utility sectors receiving around 20%. Within enterprises, state controlled firms now account for about half of all investment although their share has been declining as a result of the increasingly important role played by private enterprises. Throughout the 1980s and up until 1990, SOEs accounted for two-thirds of all enterprise investments but by 2004, their share had shrunk to just over one-third, indicating that the more dynamic private sector has been the key driver behind the recent investment boom (Barnett and Brooks, 2006). Although foreign direct investment (FDI) has carved an important niche for itself in the Chinese economy in recent years, foreign-invested enterprises (FIEs) account for a very small share of total enterprise investment. The share of such investment has consistently hovered around 10%, roughly split between foreign-invested firms and those from Hong Kong, Macao and Taiwan (Barnett and Brooks, 2006). In fact between 1982 and 2008, net FDI as a percentage of GFCF averaged around just 7.09% (refer to Appendix V).

Households and government investments

Investment by households (largely in real estate) and (direct) investment by the central government has been very modest (compared with enterprise investment) and relatively steady at levels comparable to other countries. Household investment has averaged around 5.5% of GDP since the early 1990s but it has been increasing as a result of the 1998 housing reforms. The housing reforms sped up the phasing out of subsidised socialist housing by selling apartments to state workers albeit at a fraction of the real market value. The housing

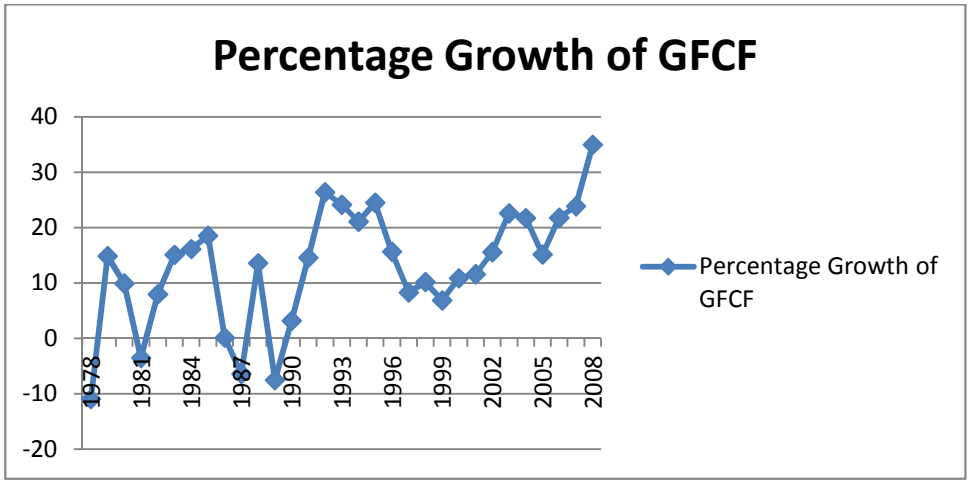
reforms also led to the establishment of a secondary real estate market when individuals began to invest their savings by swapping their old low quality socialist housing for high quality new apartment buildings. As a result, urban housing rather than commercial property development has become the key driving force behind China's real estate investments. By 2003, real estate investment was estimated to be 6.7% of GDP (Kuijs, 2005). Investment by the Chinese central government made up only one-tenth of total investment throughout the 1980s and 1990s but by 2008, it had grown to almost 4% of GDP (Ding and Knight, 2010). This growth was largely attributed to the government's proactive fiscal policy response to both the Asian financial crisis and the recent global financial and economic crisis. Nonetheless, the government's share of investment is surprisingly small but it must be noted that government investment excludes state-owned enterprises investments in infrastructure such as transport, electricity and water supply even though most of these investments are financed by capital transfers from the budget (Ding and Knight, 2010).

The Bauer-Kornai Investment Cycle Theory

In explaining investment cycles in planned socialist economies, the Hungarian School of Thought led by Bauer (1978) and Kornai (1980, 1986) postulated that economic planners adjust the rate of investment according to the shortage *intensity* in the economy. When shortage within the economy is below or around the normal rate, planners initiate and approve a large number of investment projects. Unavoidably, the high rate of investment will soon overheat the economy so planners will respond by halting new and existing investment projects to redress the balance until a new cycle begins again. The endogenous character of the cyclical fluctuation of investment is thus explained by the 'investment hunger' of enterprises and various government ministries (Roland, 1987). The main assumption with this theory is that the central government has total control over total investment. This key assumption does not hold in the case of China. Since reforms began, the unlimited pursuit of GDP growth by various levels of government is largely responsible for the 'investment hunger' in China. The central government may favour a more balanced growth strategy, as expressed in the recent 12th Five Year Plan but often, the central government is unable to keep investment expenditure strictly under control because investment decentralisation has provided subnational governments with considerable powers in capital accumulation and investment allocation. Most cities and provinces are allowed to keep increasing shares of their revenue and income for local investment. Provinces such as Fujian, Guangdong and Jiangsu have used their increased powers to diversify their revenue bases and extrabudgetary

funds. The investment project approval process has also been largely decentralised. In the 1980s, the cost of investment projects that required the approval of the State Planning Commission was raised from RMB10 million to RMB30 million and that by the State Council from RMB100 million to RMB200 million. These figures were further increased in the 1990s (Wei, 2000). As a result, from 1984 to 1994 the percentage of capital construction investment by SOEs that was administered by local governments increased from 40.6% to 59.8% (SSB, 1997). Consequently fixed investment through the state budget has declined significantly since the early 1980s (Wei, 2000).

Figure 6: The Growth Rate of Gross Fixed Capital Formation, 1978 – 2008



Source: World Bank National Accounts Data

The rapid growth in investment has often forced the central government to re-centralise the investment decision making by implementing austerity measures. As espoused by the Bauer-Kornai theory, these measures include a mandated investment reduction across all provinces (Wei, 2000). As it can be seen in Figure 6, the growth rate of investment has fluctuated greatly over time. A sharp fall, following the Tiananmen Square incident (around 18,000 investment projects were either closed or postponed) (Wei, 2000) was followed by a rapid growth in the early to mid-1990s, then a decline following the Asian financial crisis in the late 1990s, and eventually picking up again after China's accession to the WTO in 2001. The *Bauer-Kornai Investment Cycle Theory* has been widely applied to empirical work on investment in socialist countries (Grosfeld, 1987; Roland, 1987; Zou, 1995) but it is not

applicable to China because although China is still essentially a centrally planned economy its characteristics are very unique when compared with the former Soviet Union for example. The effectiveness and efficiency of China's investment policy has however been questioned by many scholars in recent years (Lai, 2008; Duo and Haiyan, 2009). To improve investment allocation and management, the central government has introduced a series of measures to prevent overinvestment. These include a mandatory project evaluation report, feasibility studies, investment orientation tax and the establishment of state-controlled investment banks (Wei, 2000).

The description and analysis presented in the first two chapters of this study illustrates the unique characteristics of savings and investments in China. Understanding these characteristics and the level of capital mobility between China and the global economy has become an important question in international economics. As China gradually integrates itself with the global economy, the assumption of a high or low level of capital mobility will have profound implications for policy makers. This is because the degree of capital mobility may significantly affect the impact of different policy instruments. Moreover, understanding the relationship between savings and investment provides an important insight into the processes that foster China's economic growth. This is because economic growth depends on capital accumulation and critically, capital accumulation stems from investment which depends on both domestic and foreign capital. Hence, the causal relationship between savings and investment has important implications for both fiscal and monetary policies. The second part of this study therefore attempts to provide the theoretical explanations and the empirical estimation of the long-run relationship between savings and investments.

PART II
THE LONG-RUN RELATIONSHIP BETWEEN SAVINGS AND INVESTMENTS – A TIME SERIES ANALYSIS

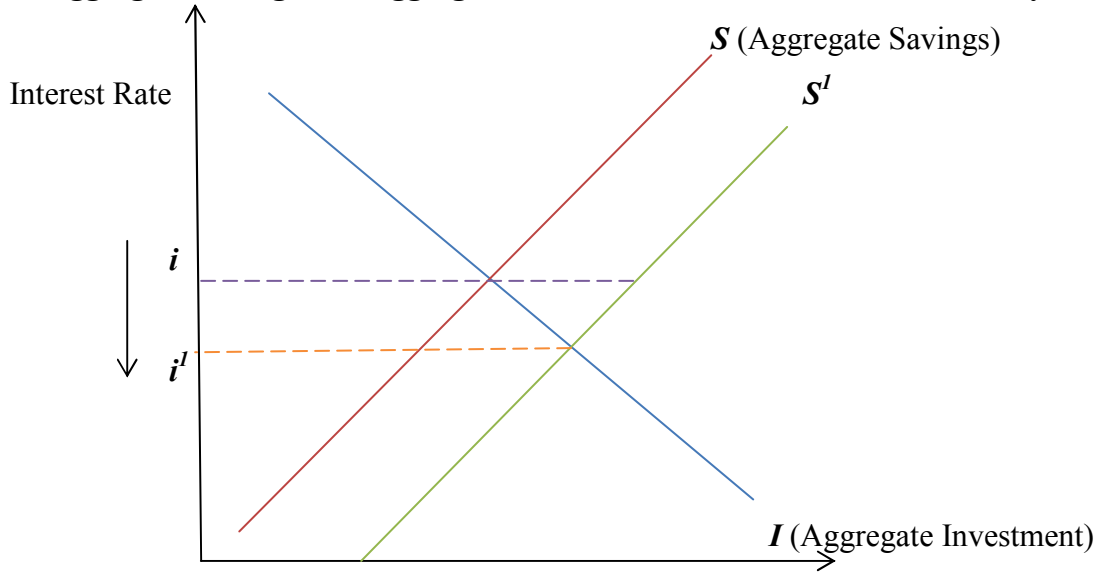
CHAPTER III – THE THEORETICAL FRAMEWORK

Throughout the 20th century, advocates of both Keynesianism and classical economics elaborated more refined conceptions of the relationship between savings and investments. In recent years however, new paradigms for savings, investment and economic growth has been explored in an attempt to address the theoretical and empirical puzzles and to assist in the design of appropriate macroeconomic policies.

The Classical Approach versus Keynesianism

The fundamental principle of the classical approach is that the economy is self-regulating. This approach which can trace its roots back to David Ricardo and John Stuart Mill in the 19th century regards savings, the supply of financial capital, to be positively dependent on interest rate. Conversely, investments, the demand for financial capital is negatively dependent on interest rates. Savings represent the limited financial means necessary for carrying out investments. In the long run, interest rate automatically brings savings and investment into productive balance (Lambsdorff, 2011).

Figure 7: Aggregate Savings and Aggregate Investment under the Classical Theory

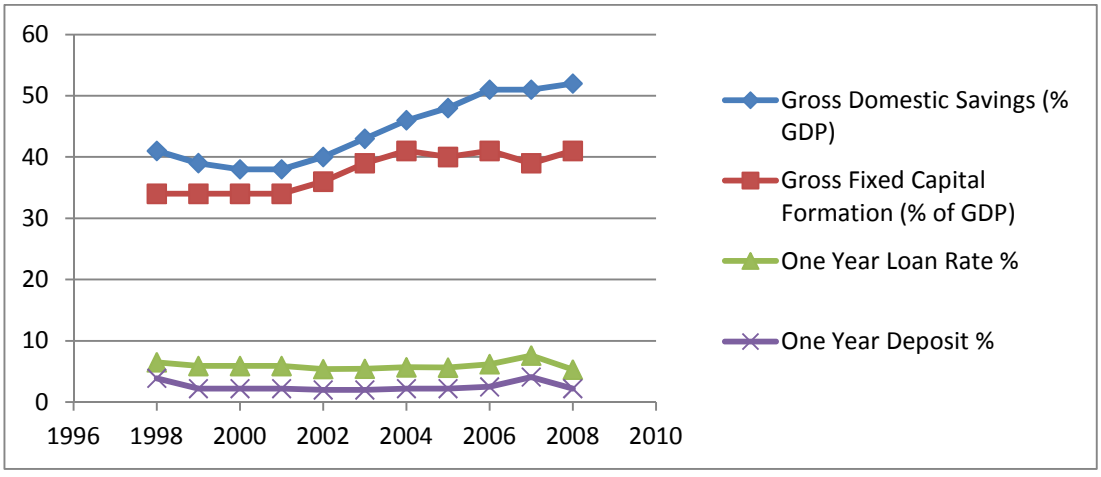


According to the classical theory, aggregate savings represented in Figure 7 as ***S*** is an upward-sloping function of interest rate. As interest rate rises, the economy responds by saving more. Aggregate investment (***I***) on the other hand is a downward-sloping function of interest rate so as interest rate rises, the cost of borrowing increases and consequently investment declines. Initially, aggregate savings and aggregate investment are at equilibrium at interest rate ***i*** but the increase in aggregate savings forces ***S*** to shift to S^1. Interest rate will then fall from ***i*** to i^1 to make supply of funds from aggregate savings equal to the new demand for funds for investment. The flexibility of interest rate is the self-adjusting mechanism that keeps the money market in equilibrium. The central principle of Keynesianism (Keynes, 1936) however rejects this theory by arguing that the alignment between savings and investment is not always automatic and misalignment often occurs with severe adverse consequences. For Keynes, savings and investment are not the main determinants of interest rates, particularly in the short run (Keynes, 1936). Rather, the present supply and demand for the stock of money is the determinant of interest rate. Keynes further argued that although in the long run savings equals investment, the two variables can be often disjointed because they occur separately from one another. Those who save include lower and middle class households whilst those who invest are primarily the entrepreneurial class, most likely the upper class. The decision to invest by the entrepreneurial class depends largely on subjective factors rather than the availability of funds at a low interest rate. Additionally, investment depends on the availability of profitable opportunities, which according to Keynes follow business cycles. Equally, the decision to save (by both households and the entrepreneurs) is not automatically coordinated to the amount needed by the entrepreneurial class to invest in the economy. This Keynes argued was due to 'liquidity preference' – the preference of potential savers to hoard money in the form of cash rather than saving it. Another principal argument of Keynesianism is the dangers of excessive savings – the level of savings that exceeds the level needed for planned investment. Excessive savings means insufficient demand for output, leading to an unwanted accumulation of inventories. The accumulation of inventories effectively encourages firms to decrease both production and employment. The Stockholm Theory of Savings and Investment which was championed by Bertil Ohlin (1937) further buttressed the Keynesian thought.

The features of savings and investment in China are more aligned to the Keynesian thought than the classical savings-investment alignment narrative. Before reforms began in 1978, the operation of monetary policy in China was largely confined to the provision of cash and

credit for the national production plan. The allocation of funds and the issuance of currency were under the strict control of the state. With the institutionalisation of market reforms, the implementation of market based monetary policy fell on the People's Bank of China when it was designated the role as the central bank of the country in 1983 (Leung and Lu 2011). As predicted by the Keynesian thought savings and investment are not interest rate elastic, particularly in China. Investment in China is mainly done by the large SOEs (the entrepreneurial class as postulated by Keynes) and crucially, the demand for investment is not responsive to changes in interest rate. This is because the primary investors (SOEs) have other objectives such as market share and employment (Leung and Lu 2011). On Figure 8, it can be illustrated that between 1998 and 2007 the one year loan rate hardly changed at all but gross fixed capital formation rose from 34% of GDP to 40% of GDP. Furthermore, there is strong evidence that seems to indicate that the concept of liquidity preference is also applicable to Chinese firms. A study by Lian, Sepehri and Foley (2011) found that Chinese firms, particularly those with more investment opportunities tend to have greater cash holdings.

Figure 8: Gross Domestic Savings and Gross Fixed Capital Formation with the Benchmark Money Market Interest Rates, 1998 - 2008



Source: World Bank National Accounts Data and Man-Kwong Leung & Qianjin Lu (2011): Changing Money Market and Monetary Policy Operations in China: an institutional perspective

Lastly, much of the recent debate about the imbalances within the Chinese economy (Bernanke, 2006, Woo, 2006) vindicates the Keynesian assertion about the dangers of excessive savings. High rates of savings over the last three decades has been accompanied by

very weak domestic consumption and worryingly, inventories, as a percentage of GDP is beginning to rise as illustrated in Figure 4.

Feldstein and Horioka (FH) Puzzle

Keynesianism emphasises that the determinants of savings are different from those of investment in that savings depend on income and wealth whereas investment depends on risk and profitability. Because of these two independent determinants, savings and investment can differ *ex ante* (Schmidt-Hebbel, Servén and Solimano, 1996). Nonetheless, in a closed economy similar to the Chinese one before reforms began, national savings and domestic investment must be equal *ex post*, thus a rise in the rate of savings will be followed by a rise in the rate of investment. In an open economy however, national savings need not to be used for domestic investment because unrestricted capital mobility makes investment abroad possible. Consequently, an increase in national savings would invariably be reflected in larger current account surplus, rather than higher domestic investment ((Schmidt-Hebbel, Servén and Solimano, 1996). In their influential contribution to international and monetary economics, Feldstein and Horioka's (1980) interpretation of a high correlation between savings and investment for a sample of sixteen OECD countries from 1960 – 1974 challenged the view that investment tends to flow to the place that yields the highest rate of return in opened liberal economies. The particular contribution of Feldstein and Horioka's work was not the originality of their argument but their use of new statistical estimates to summarise their conclusion. Out of this summary, it emerged that portfolio preferences and institutional rigidities invariably impede the long term flow of financial capital among OECD countries and hence, increases in domestic savings will be reflected primarily in additional domestic investment. Subsequent research since Feldstein and Horioka's seminal paper has further buttressed the argument that savings within a country almost equate to domestic investment in the long run. Angus Maddison 's (1992) *A Long-Run Perspective on Savings* concluded that in general, savings and domestic investment for a sample of 11 countries (these 11 countries represented about 48% of world output in real terms and close to half of global savings) tend to cointegrate. Similarly, Coakley and Kulasi (1997) also concluded that they found cointegration of savings and investment in all or most of the countries in Maddison's research and they interpreted this as a reflection of current account solvency. Narayan also found savings and investment to be cointegrated in China from 1952 – 1998. This he argued was largely due to the immobility of capital and the relatively low foreign direct investment at the time. Is a similar result possible in post 1998 China? China has witnessed some key

institutional changes since 1998. China's accession to the WTO in September 2001 opened up investment opportunities abroad for Chinese enterprises as well as investment opportunities in China for other member countries. China is now the world's second largest recipient of FDI, only behind the United States (Wang and Yao, 2002). WTO accession was followed by a landmark trade agreement with 10 South East Asian countries. The Asean-China Trade Accord aims to unite China and the South East Asian countries in a single market worth $2 trillion (Killion, 2005). Furthermore, China's search for natural resources to satisfy the demands of industrialisation culminated with the China-African Summit of 2006. Chinese trade and investment in Africa totalled more than $50 billion in 2006 alone (Zafar, 2007). The next chapter, Chapter IV provides the background analysis for the estimation of the savings-investment correlation.

CHAPTER IV – SAVINGS-INVESTMENT CORRELATION ESTIMATES

Increasing global capital mobility is an important phenomenon for economic policy makers as well as transnational corporations. Although China has historically kept significant restrictions over capital movements, recent developments, particularly its accession to the WTO and a trade accord with South East Asian countries has loosened some of these historic restrictions. In addition, the recent establishment of the Chinese Investment Corporation in 2007 (China's sovereign wealth fund) which strategically aims to diversify China's investments in various sectors across the globe has also been accompanied by the National Development and Reform Commission's (NDRC) provision of special funds for large SOEs to invest abroad (Schüller and Schüler-Zhou, 2009). It has therefore become imperative to re-examine the crucial nexus between Chinese savings and domestic investment.

Hypothesis

In its simplest form, the Feldstein and Horioka approach can be summarised as follows: with perfect global capital mobility, there should be no correlation between domestic savings and domestic investment. Domestic savings respond to worldwide opportunities for investment while domestic investment is financed by global capital. Given China's communist legacy and its historical restrictions on capital movements, the null hypothesis to be examined in this part of the paper can now be stated as follows:

Savings and domestic investment cointegrate in China in the long run. Institutional rigidities and portfolio preferences impede the long term flow of Chinese capital to other countries. Hence, in the long-run, increases in savings will be reflected primarily in increases in domestic investment.

Data

The data for this study is taken from the World Bank Databank which comprises of data from the World Development Indicators (WDI) and the Global Development Finance (GDF) for the period 1978 – 2008. The WDI is the primary World Bank database for development data from officially-recognised international sources. The integrity of the WDI ensures that the data used for this study is accurate, valid and consistent. Following Feldstein and Horioka's original study, savings is defined as gross domestic savings as a percentage of GDP and

similarly, investment is defined as gross fixed capital formation as a percentage of GDP. A summary of the data and its descriptive statistics can be found in Appendix I.

Model

To examine the savings and investment correlation for China, I will apply the generic long run model in the following form:

$$I_t = \alpha_0 + \beta_1 S_t + \varepsilon_t$$

Here, I_t is gross national investment as a percentage of GDP; S_t, the gross national savings as a percentage of GDP; α the constant term and ε_t the disturbance term. The correlation between savings and investment is determined by the size of β.

Addressing the problem of Spurious Regression

It is possible that the regression estimate for savings and investment may establish a statistically significant causal relationship even if such relationship does not exist. This is a very common occurrence in time series analysis particularly when working with non-stationary data. A mere correlation does not imply causality so it is imperative to rule out any possible spurious relationship. In order to do so, I will undertake a unit root test for the stationarity of the data series.

Econometric methodology

The literature on econometrics proposes different techniques to empirically examine the dynamic interactions and the long–run relationship between two or more time series variables. Considerable attention has been given to these techniques over the past decades. The most commonly used methods includes the Engle and Granger approach (1987) and the Maximum Likelihood-based approach (Johansen, 1988; Johansen and Juselius, 1990). Both methods require the underlying variables to be integrated of order 1 i.e. I (1) so unavoidably, the process involves stationarity pre testing. The Engle and Granger approach is employed for this study because in its simplest form, it tests for the existence of a long-run relationship between two non-stationary variables. The basic idea of this approach is that the two variables have the same stochastic trend, which causes them to have a long-run relationship.

Unit roots

To ascertain the stationarity of the data series, I will undertake a detailed investigation of the unit root properties with the Augmented Dickey Fuller (ADF) test. The ADF test will address the issue of autocorrelation arising from generating data for the y_t by introducing lags of Δy_t, as regressors in the test equation. The null hypothesis of the ADF test is $H_0 : \gamma = 0$ (i.e. the data in their levels are non-stationary and hence it needs to be differenced to make it stationary) against the alternative hypothesis of $H_1 : \gamma < 0$ (i.e. the data is stationary and hence does not need to be differenced). If the *t*-statistics for the data in their levels are greater than the critical value (the critical value is automatically generated by STATA) then the null hypothesis of non-stationarity would be accepted. Conversely, if the *t*-statistics for the data in their first differences are less the critical value, then the non-stationarity hypothesis would be rejected, indicating that the data series are integrated of order 1, i.e. I (1). After the ADF test, the residuals will be tested for autocorrelation using the Durbin-Watson test. Since its development in the early 1950s, the Durbin-Watson test has been found to be extremely useful, particularly for the analysis of time series data. The null hypothesis of the Durbin-Watson test is that the errors in the residuals are serially independent (not autocorrelated) against the alternative that they follow a first order autoregressive (AR1) process. The result of the Durbin-Watson test, *d,* always lies between 0 and 4. If the value is sufficiently close to 0, then there is evidence of positive serial autocorrelation. However, if the value is sufficiently close to 2, then the null hypothesis of no autocorrelation can be accepted.

Cointegration

The next step will be to test for cointegration using the Engle and Granger test. The test for cointegration is essentially a test for stationarity of the residuals. Calculating the critical values specific to my sample size will ensure that the interpretation regarding cointegration is correct. The concept of cointegration suggests that two non-stationary time series variables are cointegrated if they move together through time (Adkins and Carter-Hill, 2008). Economic theory would suggest that the two variables are tied together via arbitrage but it is imperative to perform a formal statistical test to establish if such a relationship exists.

Vector Error Correction (VEC) Model

If cointegration is established, I will proceed to estimate a Vector Error Correction model and interpret the cointegration relationship, particularly the short-run relationship. The VEC is simply a vector autoregressive (VAR) model with a specific type of coefficient restriction

imposed. Therefore the model is a special form of the VAR model for I (1) variables that are cointegrated. It can be expressed as:

$$\Delta y_t = \alpha_{10} + \alpha_{11} (y_{t-1} - \beta_0 - \beta_1 \chi_{t-1}) + v^y_t$$
$$\Delta \chi_t = \alpha_{20} + \alpha_{21} (y_{t-1} - \beta_0 - \beta_1 \chi_{t-1}) + v^x_t$$

From the above model, it can be illustrated that the two equations contain a common cointegration relationship as expressed by ($y_{t-1} - \beta_0 - \beta_1 \chi_{t-1}$). The coefficients α_{10}, α_{11} are referred to as the error correction coefficients because they show how a change in y_t (the change in the rate of total in investment) and a change in χ_t (the change in the rate of domestic savings) respond to the cointegrating error $y_{t-1} - \beta_0 - \beta_1 \chi_{t-1} = e_{t-1}$. What the VEC model enables us to examine is how much a dependent variable will change in response to a change in an explanatory variable. As the hypothesis suggests, an increase in the aggregate savings rate in China will most likely result in an increase in total domestic investment. However, it will take some time before the rate of investment rises in response to the change in total savings. A VEC is more appropriate to model macroeconomic data because it distinguishes between stationary variables with transitory (temporary) effects and non-stationary variables with permanent (persistent) effects.

Causality

Causality in the sense of Granger causality is typically defined in terms of the predictability of the vector of variables one period ahead (Dufour and Renault, 1998). By identifying investment as the dependent variable and savings as the explanatory variable the explicit assumption is made that a change in the rate of investment is induced by changes in the level of savings. This is the notion of causality in which information about savings is expected to affect the conditional distribution of the future rate of investment. If savings causes investment and investment causes savings, then there is a feedback, which means the two variables are jointly determined (Ramanathan, 2005). However, the apparent causality is sometimes not clear. Does the level of savings determined causes changes to the rate of investment or is it the other way round? It is therefore imperative to test for causal directions between the two variables. The results of the empirical tests are presented in the next chapter, Chapter V.

CHAPTER V – EMPIRICAL RESULTS

The penultimate chapter of this study is concerned with the application of the Engle and Granger test to examine the presence of a long-run relationship between savings and investment in China.

Unit root test for stationarity

To test for the stationarity of the data series, the ADF test is employed. This approach developed by Elliot *et al* (1996) has significantly greater power than the ordinary Dickey Fuller test. As illustrated in Table 2.1, each of the *t*-statistic for the data series in their levels (after including 1 lag for gross domestic savings and 1 lag for gross fixed capital formation) is greater than the critical value -2.989 and thus falls outside the rejection region. Hence, the null hypothesis that the data is non-stationary in their levels is accepted. However, it is also illustrated in Table 2.2 that each of the *t*-statistic for the data series in their first differences is less than the critical value -1.950. In this case, the non-stationary null hypothesis can be rejected. Therefore it can be concluded that both series are stationary in their differences (Integrated of order 1, i.e. I (1).

Table 2.1: Augmented Dickey Fuller Test for Unit Root (I)

T-Statistics, data in their levels (Critical value at the 5% level of significance = - 2.989[*])
Gross Domestic Savings (-0.191)
Gross Fixed Capital Formation (-1.219)

Table 2.2: Augmented Dickey Fuller Test for Unit Root (II)

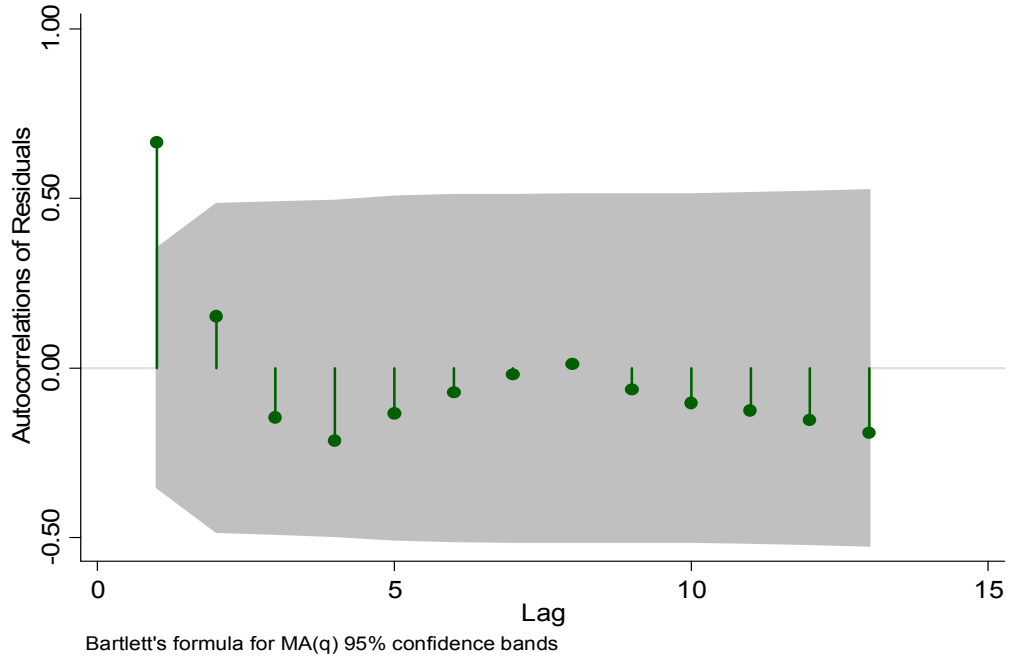
T-Statistics, data in their first differences (Critical value at the 5% level of significance = - 1.950[*])
Gross Domestic Savings (-3.719)
Gross Fixed Capital Formation (-4.169)

[*]Both critical values were automatically generated by STATA

Detecting Autocorrelation

To detect the presence or the extent of autocorrelation, the correlogram below was obtained from the residuals of the savings and investments regression estimates.

Figure 9: A correlogram of the residuals



Each 'dot' in the correlogram represents the estimated correlation between the observations at specific periods apart. The shaded area is the 95% confidence bounds. It can be observed that the first autocorrelation lies outside of the 95% confidence boundary and is therefore significantly different from zero at the 5% level. However, all the others lie within the bounds and are not significant. This illustrates that the errors in the residuals are serially independent i.e. not autocorrelated. The Durbin-Watson test also confirms this result. The *d* of the Durbin-Watson test is 1.503015. As already stated, a *d* closer to 0 means there is positive autocorrelation and conversely, a *d* closer to 4 means negative autocorrelation. The null hypothesis of no autocorrelation can be accepted if the *d* is sufficiently close to 2. Statistically, it can be argued that 1.503015 is closer to 2 than 0. However to make this decision, there are both upper and lower critical values for the *d* depending on the number of observations (*N*) and the number of explanatory variables (*k*). The structure of Durbin-Watson means that although there are acceptance and rejection regions, the critical point is not so clear cut. This is what Durbin-Watson refers to as the zone of indecision where they do not recommend rejecting or accepting the null hypothesis. Gujarati (2003) recommends that because

autocorrelation is a very serious issue if the *d* falls in either the rejection region or the indecision zone, it should be treated as evidence that autocorrelation may exist. At the 1% level of significance, Savin and White (1977:1989-1996) recommends that for a model with a constant for a sample of 30 observations with one explanatory variable, the lower (d_L) and upper (d_U) boundaries for the acceptance and rejection of the null hypothesis is should be 1.134 and 1.264 respectively as the table below illustrates.

Table 3: Critical values (at the 1% level of significance) for Durbin-Watson test based on Savin and White's Recommendation

Reject H_0 Evidence of Autocorrelation	Zone of Indecision	Accept H_0
0	1.134	1.264	2

The *d* from the Durbin-Watson test, 1.503015 falls within acceptance zone as illustrated above. This suggests that there is no autocorrelation. Consequently, the null hypothesis of no autocorrelation is accepted.

Engle-Granger test for cointegration

The Engle-Granger test involves running a static cointegration regression. Below is the result of the stationarity test of the residuals:

Table 4: Stationarity of the Residuals

Differenced Residual	Coefficient	t	*p*-value
L1	-0.5088765	-3.83	0.001
LD	0.5386255	3.27	0.003

Therefore, the unit root test for the stationarity in the estimated residuals is:

$$\Delta\hat{e}_t = -0.5088\hat{e}_{t-1} + 0.5386\Delta\hat{e}_{t-1} = 0.0298\hat{e}_{t-1}$$

$$(t\text{-}statistic)\ (-3.83)$$

It must be noted that the Augmented Dickey-Fuller test uses one lagged term Δe_{t-1} to correct for autocorrelation. The critical values for the rejection of the null hypothesis of no cointegration are detailed below.

Table 5: Critical values for cointegration test

Regression Model		5%	10%
(1)	$y_t = \beta\chi_t + e_t$	-2.76	-2.45
(2)	$y_t = \beta_1 + \beta_2\chi_t + e_t$	-3.37	-3.07
(3)	$y_t = \beta_1 + \delta_t + \beta_2\chi_t + e_t$	-3.42	-3.13

Notes: These critical values are taken from Carter-Hill *et al* (2008), *The Principles of Econometrics*, John Wiley & Sons, p.339

Since there was a constant term in the cointegration regression, the null hypothesis of no cointegration is rejected if *t*-statistic is less than or equal to the critical value in equation 2 at the 5% level of significance (-3.37). The *t*-statistic as it can be illustrated in Table 4 is -3.83. This is less than the critical value -3.37 at the 5% level of significance. Therefore the null hypothesis that the least squares residuals are non-stationary is rejected. This implies that savings and investment cointegrated in China for the period 1978 – 2008. In other words, there is a fundamental relationship between the two variables. The estimated regression between the variables is valid and not spurious. This finding has major economic implications for China. It means that when the Chinese authorities change its economic growth strategy by shifting emphasis from investments to domestic consumption as they have done with the recent Five Year Plan, the level of savings will also have to change, thereby ensuring that the effects of the change in policy are transmitted to the rest of the economy.

Estimates of the VEC Model

To check for cointegration, the fitted equation below was obtained:

$$\hat{I}_t = 0.7765519S_t \qquad R^2 = 0.7440$$

Where *I* denotes investments and *S* denotes savings. It can be observed that *I* has been normalised because it makes more sense to think of the demand for financial capital

(investments) responding to the supply of financial capital (savings). The estimated unit root test equation for the residual as established by the Engle-Granger test is:

$$\widehat{\Delta e_t} = \mathbf{0.0298}\hat{e}_{t-1}$$

$$(t\text{-}statistic) = (-3.83)$$

As already stated, the null hypothesis of no cointegration has been rejected at the 5% level of significance. This implies that the demand for financial capital (investment, I_t) in China is linked to the supply of financial capital (savings, S_t). If S_t were to increase by 1%, I_t would increase by about 0.77%. However, investment may not respond fully by this amount within the year. To ascertain how much investment will respond to a 1% increase in savings within the year, the error correction model is estimated using least squares by adding or subtracting (depending on the sign of the coefficient) a one lagged period of the residual (ê) from the constant term. The regression output of the VEC estimates is displayed below.

Table 6: Regression output for the VEC Estimates

Investment	Coefficient	t	p
ê L1.	.1096239	0.71	0.481
constant	.4153659	1.08	0.288
Savings	Coefficient	t	p
ê L1.	-.1480428	-1.25	0.223
constant	.479249	1.62	0.117

Therefore, the estimated VEC model for $\{I_t , S_t\}$ is:

$$\widehat{\Delta I_t} = \mathbf{0.415 + 0.109}\hat{e}_{t-1}$$

$$\mathbf{(t) \quad (0.71)}$$

$$\widehat{\Delta S_t} = \mathbf{0.047 - 0.148}\hat{e}_{t-1}$$

$$\mathbf{(t) \quad (-1.25)}$$

Because it was assumed that investments respond to savings, the result for both error correction coefficients are not of the appropriate sign. The positive error correction coefficient in the first equation (0.109) indicates that ΔI_t rises when there is a positive cointegrating error, while the negative error correction coefficient in the second equation (-0.148) suggests that ΔS falls when there is a negative cointegrating error. This contrasting behaviour (positive change in *I* and negative change in *S*) 'corrects' the cointegrating error. The error correction coefficient (0.109) indicates that yearly adjustments of I_t will be around 11% of the deviation of I_{t-1} from its cointegrating value of $0.776S_{t-1}$. However, this is not significant at any reasonable level. The error correction coefficient in the second equation (-0.148) indicates that ΔS does not react to the cointegrating error and it is also not significant. This outcome is inconsistent with the view that investment is likely to react to the changes in the level of savings but not vice versa. However, it can be argued to an extent that the result is consistent with the Chinese experience. As discussed in Part I of this study, Chinese domestic investment may not necessarily be funded by domestic household and government savings but rather, it may be funded through retained SOE earnings and this result can be interpreted as an illustration of that phenomenon.

Granger-Causality test

Time series data often provides both opportunities and challenges for addressing causality. To test the statistical hypothesis of whether one time series (savings) is useful in forecasting another (investments), the Granger Causality test is often employed. The intuition behind the Granger-Causality test is very simple. Let us suppose that savings Granger-cause investment in China but investment does not Granger-cause savings. In this case, past rates of savings can help forecast the level of future investment but the rate of investment will not be helpful in forecasting the rate of future savings. To examine the direction of causality between the two variables with the Granger-Causality test, the following unrestricted model is adopted:

$$s_t = \sum_{i=1}^{p} \alpha_{\,i}\, s_{t-i} + \sum_{j=1}^{p} \beta_{\,j}\, i_{t-j} + u_t$$

$$i_t = \sum_{i=1}^{p} \alpha_{\,I}\, i_{t-I} + \sum_{j=1}^{p} \beta_{\,j}\, s_{t-j} + v_t$$

Where p is the maximum number of lagged observations included in the model, s_t is the rate of savings minus its average over the sample period and similarly, i_t is the rate of investment minus its average. The test statistic is the standard Wald F-statistic. The short-run causality is determined with a test on the joint significance of the lagged explanatory variables, using the F-test. The result of the Granger-Causality test is displayed below.

Table 7: Granger-Causality Wald Test

Equation	Wald *F*-Statistic	Lags	*P*-Value
Savings	84.101	8	0.000
Investments	23.901	8	0.002

As it is illustrated above, for the savings equation, the Wald F-statistic for the omission of the investment variables is 84.101 and the corresponding p-value is 0.000 thus implying that the null hypothesis that past investment rates do not influence future savings rate can be rejected. Similarly, the Wald F-statistic for the investment equation 23.901 has a corresponding p-value of 0.002 suggesting that the hypothesis that past savings rate do not affect future investment rate, should also be rejected. This therefore leads to the conclusion that there is strong evidence of causality in both directions. In other words, not only does past savings rates determine the rate of current and future domestic investment but past rates of investment also determine the current and future rates of savings.

The Cointegrating Forecasting Model

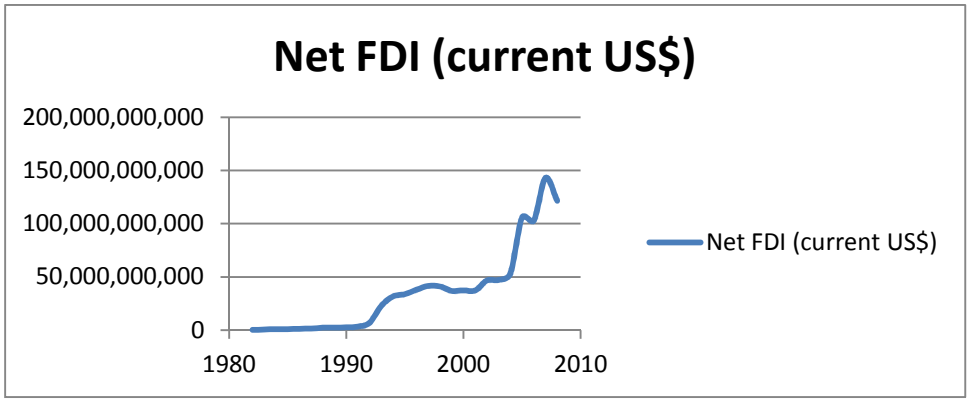
The existence of cointegration between savings and investment importantly affects the forecasts of both variables. When forecasting the future rates of savings and investment, the cointegrating combinations tend to converge at their equilibrium means, as it should be for stationary combinations. If the difference between the rates of savings and investment in China were to change permanently due to a policy shift (shifting emphasis from investment to increased domestic consumption – the main rhetoric of the recent Five Year Plan), the forecasting model will fail to correct itself after the shift to the new equilibrium position and

consequently, it will interpret the rate differential as a disequilibrium. Consequently, the model will wrongly forecast savings to revert back to the old equilibrium. For this reason, the cointegrating forecasting model should be viewed as 'equilibrium correcting' because it always adjusts to the imposed equilibrium rate whether it is correct or not (Hendry and Juselius, 2001). To address the inability of the forecasting model to correct itself after a shift to a new equilibrium position, Hendry and Juselius (2001) recommend adopting an 'open' or partial policy analyses system that is conditioned on weakly exogenous variables.

The FH Puzzle and China

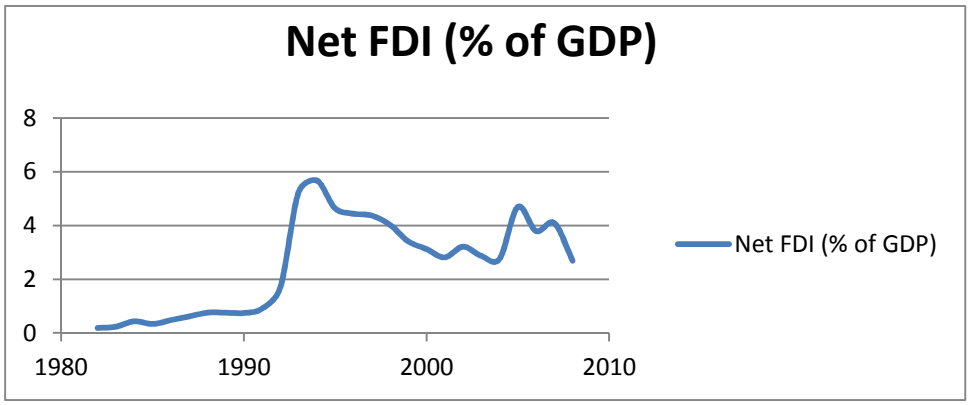
According to the theoretical explanation put forward by the FH puzzle, there should be nothing puzzling about the relationship between savings and domestic investment in China. Been a closed economy, savings and domestic investment should cointegrate in the long-run because of restrictions on capital mobility. The result of the empirical test presented in this chapter is in conformity with this hypothesis. Narayan (2005) argued that he found savings and investment in China to be cointegrated for the period 1952 – 1998 because capital mobility was fairly restricted throughout the whole period. As it can be observed in both Figures 10 and 11, the flow of FDI indicates that capital mobility has not been severely restricted since reforms began. Capital mobility may have been restricted during the 'Great Leap Forward' and the 'Cultural Revolution' but the economic reforms programme of the late 1970s resulted in at least a nominal reduction of these restrictions. It can be seen in Figure 10 that between 1982 and 2007, the value of net FDI rose significantly from just $368 million to $143 billion. Consequently, net FDI as a percentage of GDP also grew significantly, peaking at 5.68% in 1994 as shown in Figure 11. It can also be observed in Figure 12 that net FDI as a percentage of GFCF grew significantly during the 1990s but it has been declining thereafter. Since the turn of the century, it has been fluctuating around the 10% mark. These statistics may sound very impressive but they are still very modest when compared with domestic enterprise investments. According to estimations by Barnet and Brooks (2006) domestic enterprise investments as a percentage of total investment was over 75% between 1995 and 2005. Consequently, the modest impact of net FDI has not been reflected in China's savings-domestic investment correlation estimates.

Figure 10: Net FDI* (current US $) in China, 1982 – 2008



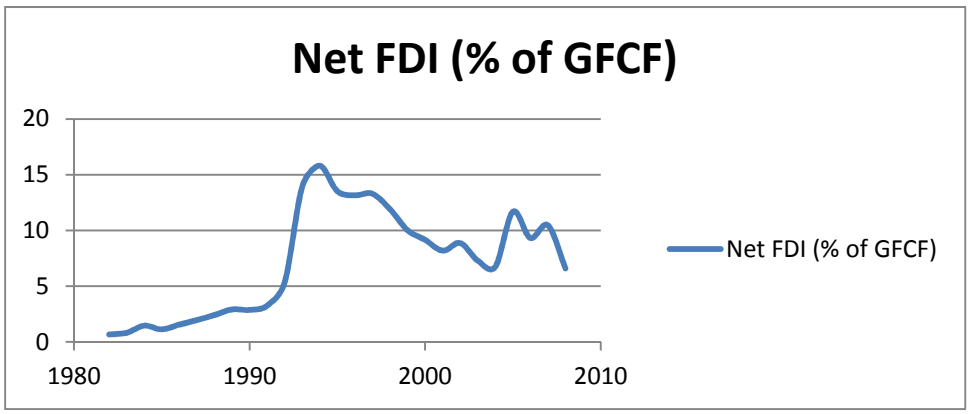
Source: World Bank data

Figure 11: Net FDI (% of GDP) in China, 1982 – 2008



Source: World Bank data

Figure 11: Net FDI (% of GFCF) in China, 1982 – 2008



Source: World Bank data

Net FDI is defined as the net FDI in China from foreign sources, less net FDI by China to the rest of the global economy.

CHAPTER VI – SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

Much has happened in China during the three decades of economic reforms. The 1980s and 1990s witnessed an unprecedented increase in the levels of both savings and investment. The sustainability of China's economic growth which has averaged around 9% since reforms began is conditioned, among other exogenous factors, on the crucial relationship between consumption, savings, and investments.

Summary

The positive correlation between savings and domestic investment is now an empirically established fact and it has been well documented since the seminal work of Feldstein and Horioka in 1980. Recent trends in China's national savings and domestic investment rates have raised questions about the sustainability of their levels.

The present paper was designed to describe, model and estimate the relationship between China's savings and domestic investment rates. The paper found that rising aggregate savings rate in China since 1978 has been reflected in all three sectors – households, corporate and government. The notion of forced savings was examined and it was concluded that forced savings provides only a partial explanation for China's high savings rate because it can be expected that households may substitute other commodities for unavailable consumer goods and hold precautionary stocks in both currency and commodities. Corporate restructuring and the institutionalisation of market reforms have played more important roles in the accumulation of savings. China's high investment rate on the other hand is a product of weak constraint on enterprise investment expenditure and fiscal federalism as a result of economic decentralisation. Enterprises have access to a large pool of capital for investment activities because many of them were not required to pay out any dividends before 2007. China's fiscal federalism has also meant that the central government has no direct control over the investment expenditure for most provinces. The zeal for economic growth through investment by the leaders of most of these provinces has contributed immensely to the high levels of investment. Hence, the Bauer-Kornai investment cycle theory cannot explain China's high investment rates because its assumption that the central government has direct control over all investment activities does not hold for China.

The characteristics of savings and investments in China are best explained by Keynesian thought rather than classical economics. The classical assumption that savings and

investments are interest rate elastic does not hold for China. The demand for investment in particular is not responsive to changes in interest rate because the large SOEs that are responsible for most of the investments in China have other objectives besides profit maximisation. Objectives such as market share and employment are key considerations in any investment decision making. The recent debate about the imbalances within the Chinese economy is also explained by the Keynesian argument about the dangers of excessive savings.

The Feldstein and Horioka puzzle, one of the most widely discussed problems in macroeconomics and international finance is highly applicable to China. During the pre-reform era, capital mobility was restricted so invariably savings and investments were highly correlated. However, the liberalisation of the economy in the post-reform era has meant that the restriction on capital mobility has loosened. The Engle and Granger test was thus employed to test the long-run relationship between savings and domestic investment for the period 1978 – 2008. The data used for the estimation of the relationship was from the World Bank Databank. A detailed investigation of the unit root properties of the data series was undertaken with the Augmented Dickey Fuller (ADF) test. The result of the ADF test indicated that the data series were non-stationary in their levels but stationary in their differences i.e. integrated of order 1 or I (1). A test for autocorrelation of the residuals with the Durbin-Watson test found no evidence of autocorrelation. The Engle and Granger test for cointegration established that savings and investment indeed cointegrated for the period 1978 – 2008. To interpret the short-run cointegrating relationship, the Vector Error Correction (VEC) model was employed. The VEC model did not produce the appropriate sign on both error correction coefficients and both coefficients were not significant at any reasonable level. This result challenged the view that investment was likely to react to changes in the level of savings but not vice versa. The next step was to address the issue of causality, using the Granger-Causality test. The joint significance of the *F*-test indicated that there was strong evidence of causality in both directions. In other words, savings Granger-causes domestic investment and similarly, domestic investment Granger-causes savings.

Conclusions

This paper had two distinct objectives. The first objective was to attempt to explain how China has managed to generate such high levels of savings and investment by analysing the sources of, and factors behind China's savings and investment rates. The second objective was to empirically re-examine the long-run relationship between savings and domestic

investment in China. With regards to the first objective, it is found that household savings, while high, do not explain China's high savings rates as a whole. High savings rates among enterprises, in the form of retained earnings and high central government savings through low consumption and high tax receipts have been the driving force behind China's high savings rate. Investment on the other hand is primarily financed with domestic savings (mostly enterprise savings) with FDI playing a relatively modest role. Weak constraint on enterprise investment expenditure, fiscal federalism and economic decentralisation are the main reasons behind China's high investment rates. To address the second objective of the paper, the Feldstein and Horioka puzzle was employed as the theoretical foundation to empirically examine the long-run relationship between savings and domestic investment. Using the Engle and Granger approach, an estimated *t*-statistic of -3.83 was used as evidence that there is a long-run relationship between savings and domestic investment in China.

Feldstein and Horioka built their seminal research on the theory that in a closed economy, savings and investment would be highly correlated because of restriction on capital mobility. However, they found a high savings-investment correlation for a sample of 16 OECD countries despite their more opened and integrated markets. This correlation has puzzled many economists and policy makers. As a result, two schools of thoughts have emerged since that seminal paper. One school of thought has attempted to examine the relationship between savings and domestic investment with larger samples and more advanced and sophisticated econometric methodologies whilst the other has attempted to offer an alternative hypothesis to explain this puzzling phenomenon. This study did not position itself with either school of thought. The paper simply examined the underlying patterns of savings and investment in China since reforms began with particular emphasis on institutional change, before estimating the savings-domestic investment correlation. The result of this study which indicates that there is a high savings-domestic investment correlation in China is not at all surprising. Despite the fact that China is one of the world's largest recipients of FDI, the impact of FDI on China's domestic investment is very modest compared to the Asian 'Tiger' economies of Taiwan, Singapore and Hong Kong for example. This is because the Chinese economy is still fairly insulated from international capital flows. The result of this study leads me to accept the null hypothesis stated in Chapter IV and conclude that savings and domestic investment indeed cointegrate in China in the long run. Portfolio preferences and institutional rigidities impede the long term flow of Chinese capital to other countries and hence, increases in Chinese savings will invariably result in increases in domestic investment. Nonetheless,

Feldstein and Horioka's seminal research still remains a puzzle for opened, liberal economies with integrated markets such as those of the OECD. With China's gradual integration with the world economy and the global financial system, future research on the relationship between Chinese savings and domestic investment is likely to produce similar results as those obtained in the present paper. In a world in which the observed pattern of capital flows exhibits the characteristics of a closed economy, why does public policy continues to be constructed in line with the variants of a perfect capital mobility hypothesis? Policy instruments for sound fiscal, monetary and trade policies must be used to facilitate the understanding of the pattern of capital mobility within the global economy.

Policy Implications

As mentioned throughout this study, the main rhetoric of the recent 12th Five Year Plan is shifting emphasis away from investment to domestic consumption. The result of this study may have some implications for the policies that may be implemented to drive this strategic change. First, by reducing the government's share of national savings, the Chinese authorities can influence the level of domestic consumption. Between 1999 and 2009, domestic consumption as a percentage of GDP fell from 45% to 36% (Kuijs, 2005). At the same time, government revenue as a share of GDP increased significantly whilst government consumption remained low. Large capital transfers through social welfare initiatives on education, health and social security will boost government spending and aggregate consumption and directly reduce national savings and investment. The scope for such a shift will be significant given that government savings are often channelled to SOEs for investment. In addition, a shift in policy away from the promotion of capital-intensive industry to labour-intensive activities, including services would invariably increase the share of labour income in the economy. In the short-run, the marginal propensity to consume will increase thereby increasing consumption. As stated in Chapter II, the high rate of investment in China is driven by excessive enterprise investment expenditure. Adopting a western-style corporate governance code, increasing dividend pay-outs and paying close attention to the allocation of capital would improve the efficiency of capital and shift the trade-off between consumption and investment towards more consumption. Furthermore, since the Chinese economy is still heavily reliant on exports, an appreciation of the yuan renminbi would reduce the profits of Chinese exporters. Since profits are often reinvested, aggregate investment would fall as a result.

In the long-run, the levels of both savings and investment in China are likely to fall due to endogenous factors. The eventual development of capital and financial markets will reduce the number of credit constrained consumers as well as small private enterprises who often fail to obtain loans from the state banks. Consequently, the associated need for saving for such needs will be diminished. Lastly, the eventual moderation in the rate of economic growth in the next decade is likely to put a downward pressure on both savings and investments. Recent economic indicators suggest that the growth of the Chinese economy is beginning to slowdown. In March 2012, the Chinese authorities revised its economic growth forecast from 8% to 7.5% (Financial Times, 2012). The growth of China's GDP for the first and second quarters of 2012 fell by 0.8% and 0.5% respectively (BBC, 2012). According to estimations by Modigliani and Cao (2004) a fall in long term GDP growth rate by 2 percentage points in China would lead to a staggering 5 percentage point reduction in household savings alone. Should this be reflected in the other two components of savings i.e. corporate and government, China's aggregate savings rate would fall by as much as 15 percentage points. The cointegration of savings and investment will mean that investment would also fall as a result.

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Appendix I

China's Gross Domestic Savings and Gross Fixed Capital Formation (% of GDP), 1978 – 2008.

Year	Gross Domestic Savings	Gross Fixed Capital Formation
1978	37	29
1979	35	28
1980	35	29
1981	34	27
1982	36	28
1983	35	29
1984	35	30
1985	34	30
1986	36	31
1987	37	32
1988	37	31
1989	36	26
1990	39	26
1991	39	28
1992	39	32
1993	42	38
1994	44	36
1995	44	34
1996	42	34
1997	42	33
1998	41	34
1999	39	34
2000	38	34
2001	38	34
2002	40	36
2003	43	39
2004	46	41
2005	48	40
2006	51	41
2007	51	39
2008	52	41

Descriptive Statistics

Variable	Observations	Mean	Std. Dev	Min	Max
GDS	31	40.16129	5.158144	34	52
GFCF	31	33.03226	4.643877	26	41

Appendix II

The Percentage Growth of Gross Domestic Savings and Gross Fixed Capital Formation in China, 1978 – 2008

Year	Growth of GDS	Growth of GFCF
1978	11.19	-10.97
1979	13.28	14.84
1980	5.24	9.9
1981	-0.43	-3.54
1982	12.33	7.95
1983	11.64	15.08
1984	11.52	16.13
1985	15.6	18.52
1986	0.97	0.13
1987	-6.41	-6.4
1988	13.09	13.58
1989	9.15	-7.53
1990	13.8	3.18
1991	6.62	14.56
1992	9.57	26.38
1993	11.71	24.14
1994	31.85	21.06
1995	26.35	24.5
1996	15.27	15.65
1997	12.73	8.28
1998	2.81	10.17
1999	0.97	6.86
2000	6.69	10.86
2001	12.79	11.57
2002	17.68	15.56
2003	23.22	22.59
2004	25.25	21.73
2005	19.88	15.14
2006	28.98	21.76
2007	29.58	23.86
2008	32.65	34.97

Appendix III

Gross Domestic Savings (in current US $) for China, UK, US, India and Japan, 1978 - 2008

Year	China	UK	US	India	Japan
1978	55,323,793,056	70,709,179,512	475,800,000,000	27,401,023,497	320,803,871,778
1979	62,672,801,717	88,875,093,029	541,400,000,000	29,830,194,504	323,949,247,015
1980	65,962,163,890	108,721,821,985	547,900,000,000	28,317,655,389	334,713,852,011
1981	65,674,226,744	98,456,591,640	647,800,000,000	37,179,844,564	374,927,934,621
1982	73,773,239,616	92,395,178,197	583,700,000,000	38,029,174,426	335,976,725,860
1983	82,362,608,504	86,936,486,282	604,600,000,000	37,551,257,253	356,027,753,012
1984	91,855,001,530	81,492,418,196	730,600,000,000	41,709,705,096	389,898,392,889
1985	106,185,038,527	91,228,182,752	734,200,000,000	48,396,799,320	436,949,747,573
1986	107,223,969,435	100,857,519,789	738,800,000,000	52,180,275,782	652,491,159,789
1987	100,344,842,194	128,040,529,498	767,100,000,000	56,881,950,979	785,296,484,142
1988	113,485,062,557	155,044,468,161	837,400,000,000	65,082,828,673	994,516,546,724
1989	123,874,306,271	159,188,481,675	928,500,000,000	66,120,894,698	1,013,540,267,212
1990	141,002,735,603	182,947,443,182	938,900,000,000	72,193,303,163	1,043,762,598,780
1991	150,345,176,005	174,432,098,765	939,200,000,000	58,793,725,509	1,197,399,137,025
1992	164,742,663,081	167,244,647,245	999,600,000,000	56,519,015,426	1,277,217,719,111
1993	184,045,526,905	149,077,684,463	1,058,700,000,000	58,623,328,179	1,409,212,494,567
1994	242,667,130,672	172,144,168,962	1,178,500,000,000	75,120,546,776	1,477,910,023,764
1995	306,624,194,446	197,091,683,762	1,241,500,000,000	90,500,989,543	1,599,003,064,381
1996	353,456,685,352	206,781,591,264	1,344,100,000,000	81,350,370,001	1,405,124,246,085
1997	398,467,513,141	242,085,789,129	1,502,900,000,000	93,065,212,244	1,302,478,543,871
1998	409,703,264,322	256,508,777,741	1,575,100,000,000	87,215,062,300	1,129,015,536,443
1999	413,714,686,689	250,325,190,099	1,628,000,000,000	108,812,282,641	1,198,722,152,886
2000	441,407,325,906	233,575,427,447	1,654,600,000,000	106,953,796,044	1,305,036,309,640
2001	497,878,657,156	222,447,099,467	1,572,400,000,000	111,286,822,291	1,100,485,515,082
2002	585,926,183,351	233,426,258,993	1,517,700,000,000	122,959,254,308	1,015,478,928,564
2003	721,998,432,346	268,816,326,531	1,530,600,000,000	152,742,668,373	1,101,093,240,091
2004	904,349,284,399	316,089,933,721	1,664,800,000,000	224,146,664,441	1,231,131,195,116
2005	1,084,216,797,530	310,993,858,159	1,779,400,000,000	266,195,042,069	1,235,833,558,251
2006	1,398,513,784,130	353,088,482,337	1,913,600,000,000	309,287,567,278	1,205,889,879,302
2007	1,812,284,320,052	428,347,326,381	1,963,700,000,000	424,004,900,180	1,245,496,452,151
2008	2,404,065,282,556	375,960,997,562	1,783,900,000,000	357,619,690,699	1,305,536,685,121

Appendix IV

Gross Domestic Savings (% of GDP) for China, UK, US, India and Japan, 1978 - 2008

Year	China	UK	US	India	Japan
1978	37	22	20	21	33
1979	35	21	20	21	32
1980	35	20	19	17	31
1981	34	19	20	21	32
1982	36	19	19	20	31
1983	35	19	16	18	30
1984	35	19	18	21	31
1985	34	20	17	22	32
1986	36	18	15	22	32
1987	37	18	16	21	32
1988	37	18	17	22	33
1989	36	19	16	22	34
1990	39	18	15	22	34
1991	39	17	15	22	34
1992	39	15	15	23	34
1993	42	15	14	22	32
1994	44	16	16	24	31
1995	44	17	16	27	30
1996	42	17	17	23	30
1997	42	18	18	25	31
1998	41	18	19	23	29
1999	39	17	18	26	27
2000	38	16	18	25	28
2001	38	15	16	25	27
2002	40	14	14	27	26
2003	43	14	14	28	26
2004	46	14	14	33	27
2005	48	14	15	34	27
2006	51	14	16	35	28
2007	51	15	14	37	28
2008	52	14	12	33	27

Appendix V

China's Net FDI (current US $) and Net FDI (% of GFCF), 1982 – 2008

Year	Net FDI (Current US $)	Net FDI (% GFCF)
1982	386,000,000	0.56
1983	543,000,000	0.69
1984	1,124,000,000	1.25
1985	1,030,000,000	0.87
1986	1,425,000,000	1.24
1987	1,669,000,000	1.66
1988	2,344,000,000	1.99
1989	2,613,000,000	2.03
1990	2,657,000,000	2.05
1991	3,453,000,000	2.51
1992	7,156,000,000	4.51
1993	23,115,000,000	11.79
1994	31,787,000,000	13.46
1995	33,849,200,000	11.09
1996	38,066,000,000	10.99
1997	41,674,000,000	11.52
1998	41,117,000,000	10.87
1999	36,978,000,000	9.28
2000	37,483,300,000	8.9
2001	37,357,000,000	7.77
2002	46,789,569,179	8.49
2003	47,228,992,592	6.98
2004	53,131,430,172	6.35
2005	105,902,597,865	11.14
2006	102,922,036,119	8.82
2007	143,056,981,635	9.8
2008	121,676,678,504	6.1