Essays on Banking Efficiency, Access to Finance and Firm Performance in China

by

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Submitted to the Economics Department
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

at the

UNIVERSITY OF LEICESTER

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Acknowledgement

I would like to express my gratitude to the Department of Economics at the University of Leicester who appointed me Graduate Teaching Assistant and offered the opportunity to pursue my doctorate. I am particularly thankful to Prof. Panicos Demetriades for his continuous help and support over the years.

To my supervisor Dr Sourafel Girma whose unfailing guidance, stimulating suggestions and encouragement helped me through this whole endeavour, I am deeply indebted and grateful for leading me into the academic world.

I would also like to thank Dr. Martin Hoskins for his invaluable comments, advices and corrections during the whole development of this work as well as Dr. Holger Görg who has been an insightful external examiner. A special thanks to my good friend Kavita Sirichand for repeatedly proofreading my work.

I could not say enough for my parents, my sister and grandma whose immense love has always been my endless source of strength and inspiration. My lifelong friend WH will never be forgotten as without him nothing could be possible. Last but surely not least, from the bottom of my heart I would like to thank my best friend and companion Mike, who kept my laughing in the hard times, for his help in all aspects of my life and work, and above all his tolerance and love.

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Abstract

This thesis aims to contribute to the under-researched area of China's financial system and its role of fostering firm growth. This is achieved by investigating three aspects of the efficiency of the Chinese financial system. The first aspect focuses on the suppliers of financial resources (i.e. banks) and examines the cost efficiency and productivity growth of the Chinese banking industry. The second aspect considers the recipients of finance – manufacturing firms, and investigates how sources of finance in a firm's capital structure affects its growth performance. The third aspect concentrates on a particular growth channel (exporting) and investigates the interaction between access to domestic finance, foreign direct investment, and the exports of private enterprises. Overall, I find that the Chinese banks lack cost efficiency, the allocation of financial resources through state-owned financial institutions is inefficient, and there is a positive association between access to finance and export market orientation.

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CHAPTER ONE: INTRODUCTION

1.1 CONTEXT AND BACKGROUND

Over the past 25 years, China has made an impressive emergence as a fast-growing economy. On average its annual GDP growth is around 9.5%, and the total GDP has reached US$2.3 trillion by 2005. China now ranks as the world's fourth largest economy after USA, Japan and Germany. With its dynamic export growth and large influx of foreign capital[1], China has rapidly integrated into the global economy to become the world's foremost manufacturing centre. As China opens hitherto closed sectors to foreign trading partners following its entry to the World Trade Organization (WTO) in 2001, the internationalisation of the economy is only expected to accelerate.

On the other hand, China's reforming process is still largely incomplete (Yusuf et al, 2006). In the process of its progressively deepening integration, China's financial, accounting, legal and corporate institutions are converging to those of other market economies rather slowly. Hence, despite an optimistic prospect of continuing growth in the near future, the economy faces many daunting challenges. One particular challenge relates to reforms in the financial sector. China's financial system is arguably "the weakest link" of its economic chain. In the absence of a primary capital market, the financial system has been for a long time dominated by its banking sector. The banking sector in turn is dominated by four state-owned commercial banks (SOCBs) that are unfortunately riddled with problems, such as bad loans and inefficient resource allocation (e.g. Lardy, 2000; Aziz and Duenwald, 2002; Boyreau-Debray, 2005; Allen *et al*, 2005). Some estimates suggest that the average level of

[1] China was the third largest exporting country in the world after USA and Germany in 2005, and the third largest foreign direct investment recipient in the world after UK and US. Its accumulated foreign direct investment has amounted to nearly 16.3% of the total domestic investment by 2002 (China Statistics Yearbook 2003).

non-performing loans (NPLs) is likely to be more than 40% of the total loans (see Allen *et al*, 2005). Bad loans in state-owned banks are mainly from state-owned enterprises (SOEs), which makes SOCB reforms and SOE reform inextricably linked. Meanwhile, these reforms are also pressing, as both SOCBs and SOEs are facing ever-increasing competition in both domestic and global markets.

There is a fast growing literature of the Chinese economy and its financial system. While the currently available studies have tried to document some aspects of China' banking industry, stock market and firm's financing pattern, most of the work has been conducted mainly at either national level, area or regional level, or based on case studies and very limited micro-level data. For instance, studies report inefficient allocation of state finance and unsatisfying result of financial deepening by Aziz and Duenwald (2002) and Boyreau-Debray (2003[2], 2005) are based on provincial level data. Examples also include the most recent case study by Allen et al (2005) and Cull and Xu (2005) which is based on survey information from 18 cities. On one hand, these studies are interesting, important, and provide a good basis for following research. On the other, they may suffer from considerable aggregation bias by using macro level data, or may not represent an overview by using case studies and limited micro data. Hence further research is needed to provide in-depth analyses and up-to-date information on the performance of the financial sector and the link between finance and growth. This will help us understand better the mechanism how finance facilitates economic growth in China and draw policy implications which may be informative as well to other transitional economies in similar development paths.

[2] For example, Boyreau-Debray (2003) finds the credits extended by the banking sector to SOEs has a negative impact on provincial economic growth and hence concludes that China's financial deepening during the 1990s did not contribute to local economic performance.

Aiming to do so, this thesis contributes to the literature by providing a systematic econometric examination of the issues related to the efficiency of China's financial system, using two comprehensive micro datasets. To be specific, three topics are explored: (i) the cost efficiency and productivity growth of the Chinese banking industry; (ii) capital structure and firm growth in the Chinese manufacturing sector; and (iii) the interaction between access to finance, foreign direct investment and the exports of private enterprises.

These topics are inter-related, with distinct features, making them interesting in their own right. The first topic considers the efficiency of the financial system from the perspective of suppliers of financial resources, i.e. banks. The second focuses on the recipients of finance and explores the finance-growth nexus amongst manufacturing firms. Finally, the third topic examines exporting, as a particular channel of growth, and the role of finance in this growth channel amongst a group of firms that is most discriminated by the existing financial system. Section 1.2 provides a more detailed account of these three topics.

1.2 AIM, OBJECTIVES AND STRCTURE OF THE THESIS

The aim of this thesis is to gain a deeper understanding of the performance of China's contemporary financial system and the relationship between the financial sector and economic growth at micro level, through three empirical chapters.

1.2.1 Are Chinese banks economically efficient?

This first empirical chapter investigates the efficiency of the Chinese banking industry. Little is known about China's banking sector even though it has crucial role in the economy. While a few studies have examined the historical evolution and current development of the banking

industry, there is no clear and systematic investigation of banking operations in China due largely to the lack of information. The aim of Chapter two is set to offer a detailed analysis of the cost efficiency and productivity performance of the Chinese banking sector. To this end, a newly available quarterly panel dataset over a span of 1995 to 2002 is employed which includes fourteen major banks in China that account for 85% of the banking market.

The three objectives of this chapter are:

(i) To model the cost structure of the Chinese banking industry, with a careful examination of the appropriateness of a popular cost function – the multiple outputs translog cost function – as the framework of the analysis. Apart from ensuring the appropriateness of the modelling, it is also hoped this would provide a useful reference for future research using similar banking data;

(ii) To estimate the Chinese banks' economies of scale and economies of scope, following Panzer and Willing (1977), and productivity growth following Caves, Christensen and Swanson (1981) in the cost function framework. The results will provide an insight into the mechanisms that contribute to the banks supposed inefficiency;

(iii) The third object is to compare the cost efficiency and productivity growth of state-owned banks (SOCBs) and joint stock commercial banks (JSCBs), and shed light on the role of ownership structure in the efficiency of the Chinese banking industry. This would inform the ongoing policy debate, especially in terms of providing an indication of where the strength of the private sector might lie.

The results show that the JSCBs enjoy economies of scale in 90% of the cases, whereas all the SOCBs exhibit significant diseconomies of scale. There are no sizeable economies of scope amongst the JSCBs and a large proportion of the SOCBs display diseconomies of

scope. Furthermore, Chapter two also shows that the productivity growth performance of the Chinese banks, including the JSCBs, leaves a lot to be desired.

1.2.2 Does source of capital matter to firm growth?

The second empirical chapter is concerned with the efficiency of the Chinese financial system from the angle of recipients of financial resources, i.e. firms. Specifically it explores the extent to which financial resources are employed productively by Chinese manufacturing firms. Here two questions are of particular interest:

(i) Does the source of finance in a firm's capital structure matter to firm growth? For instance, is finance from private sources more efficient than that from public sources in promoting firms' growth?

(ii) Do firm characteristics, such as ownership structure, size and location, mediate the relationship between access to finance and performance?

These questions are important, firstly because systematic analyses that quantify the extent of China's financial resource misallocation have been sparse in the literature. Secondly, against the background of China's accession to the WTO and its commitment to open hitherto closed financial sectors to foreign and domestic private investors, it is important to evaluate the relative efficiency of foreign and domestic finance in promoting growth, in order to identify the type of firms that are most likely to benefit from foreign and private finance. Thirdly, contrary to the commonly held belief that a well-developed financial system is necessary for growth (Levine, 2005), China is found to be an important counter-example for which, despite the lack of access to formal financing channels and weak legal protection, the private sector is driving its phenomenal growth (Allen et al, 2005).

Chapter three extends the existing literature on finance and growth in China by highlighting the relative importance of informal financing sources to firm growth. As the fourth reason, it is now well documented that notwithstanding state subsidies and easy access to bank credits, the majority of SOEs are still performing badly (e.g. Lin et al 1998). Hence a detailed microeconometric analysis of their growth and financing pattern provides insight into the optimal financing structure for SOEs' growth, thereby inform the policy debate regarding the future direction of enterprise reform in China.

The empirical analysis draws on an unbalanced panel dataset based on the Annual Reports of Industrial Enterprise Statistics compiled by the National Bureau of Statistics (NBS) of China. The sample consists of more than 166,000 firms over the period 1999-2002. These firms are estimated to account for nearly 88% of total industrial output[3]. The detailed information contained in the dataset allows for an investigation of the firm growth-finance nexus in greater detail than has been attempted in the literature. The econometric analysis is conducted using an augmented firm growth framework, and various econometric techniques are applied to ensure that the results are robust to potential problems of firm heterogeneity, endogeneity of finance variables and selectivity bias.

I find robust evidence that the source of finance of a firm's capital matters to its growth. There is a discernible pecking order of how efficiently different financing channels drive firm growth: this runs in a decreasing order of importance, from foreign finance, to self-raised finance, to domestic bank loans and finally to state budgets. Further analysis also shows that the link between capital structure and firm growth exhibits considerable heterogeneity across ownership structure, firm size groups and locations.

[3] This is calculated based on the dataset used in this chapter and the aggregate data in Chinese Statistical Yearbook 2003.

1.2.3 Does access to finance promote exporting?

Chapter four focuses on exports as a particular route of growth, and provides a microeconometric analysis of the relationship between access to external finance, foreign direct investment (FDI) and the export performance of Chinese private enterprises. This investigation is motivated by Huang (2003, 2004) who argues that foreign invested enterprises (FIEs), especially those in labour-intensive industries, reduce the chance of exports of financially constrained indigenous private enterprises. The inference here is that the huge FDI inflow into China should be recognized as diverting resources from domestic firms which do not directly benefit from FDI.

Theoretically, the trade literature has examined the relationship between finance and exports from different perspectives. Within an augmented Heckscher-Ohlin model, Kletzer and Bardhan (1987) predict that countries with well functioning financial systems tend to export more goods produced in industries that are heavily dependent on external finance. Chaney (2005) shows that in the presence of fixed costs associated with exporting, some firms do not export because of liquidity constraints.

This chapter contributes to the existing literature by modelling the interaction between access to external finance, FDI and firm exports of private firms in China which are known to suffer from discrimination by the country's financial system. Specifically, two questions are considered: (i) is there a link between access to finance and firms' exports? and (ii) what is the impact of FDI on the exporting behaviour of indigenous enterprises? The analysis is carried out using detailed information of more than 28,000 domestic private enterprises from the Chinese manufacturing sector, using the same dataset as in Chapter three.

Controlling for the heterogeneity and endogeneity of FDI and access to finance, the empirical results suggest that access to bank loans are associated with greater export markets orientation, especially amongst politically unaffiliated firms in labour-intensive industries. The chapter concludes that, in order to foster the exports of indigenous enterprises, the elimination of financial discrimination against private firms is likely to be a more effective policy tool than the reliance on spillovers from multinational firms.

CHAPTER TWO: COST ECONOMIES AND EFFICIENCY IN THE CHINESE BANKING INDUSTRY: EVIDENCE FROM A QUARTERLY PANEL DATASET

2.1 INTRODUCTION

In the face of increasing domestic and international competition, banks are relying more and more on exploiting cost economies and enhancing efficiency to increase their profit margins. The study of cost economies and efficiency therefore has been an integral part of the academic research agenda concerning the banking industry.

There is vast literature of banking efficiency that has examined efficiency effects of various types of banks and under different ownership, with a chief focus on developed economies. For example, among others, Berge and Mester (1997) on US banking; Zardkoohi and Kolari (1990) on Finish banks; Dietsch (1993) on French banks; Lang and Welzel (1996) on German banks; and Drake and Weyman-Jones (1992) for UK banks). Berger and Mester (1997) offers an excellent survey on earlier work. There are a few studies on developing economies too. For example, Fields et al (1993) on Turkish banks, Mertens and Urga (2001) on Ukraine banks, and Rezanian and Mehdian (2002) for Singapore banks. Most studies have focused on the link between efficiency and bank size, and the results more or less draw conclusion that the average cost curve is U-shaped and economics of scale exist only for small banks (Humphrey, 1992). Meanwhile they are inconclusive about their economies scope.

Studies of the Chinese banks have been conspicuous by their deficiency. The only studies of Chinese banks use ratio comparison analysis (for example, Li et al., 2001), staying

at a descriptive level and can hardly offer results comparable with those that modern efficiency methodologies provide. There are also some studies that document the banking reforms (for example Shiria, 2001) and the entry of foreign banks (for example, Leung, 1997; Leung, Yong, and Rigby, 2003). Very few studies of Chinese bank's efficiency have given an ambiguous and many are contradictory results. For instance, Chen, Skully and Brown (2005) use the data envelopment analysis (DEA) method to examine the period of 1993-2000 with a focus of comparing pre- and post-deregulation. They find that the state-owned commercial banks (SOCBs) and the small joint-equity banks are cost efficient relative to the medium-sized joint-equity banks. But another recent paper using the input distance function approach finds contrary results (Kumbhakar and Wang, 2005). This suggests that the search of an appropriate and robust methodology is still under way for the case of Chinese banks at certain period. The question is whether we should rely more on data (in which case nonparametric approaches would be considered) or more on economic modelling (by allowing disturbance and imposing certain assumptions). Like any other economic topic, this understandably takes more than a few papers or several debates to answer. But it is worth the effort, considering the importance of the research question, given the dominant position of the banking sector in China's financial system, which seems to be the weakest link in this globally important economy.

The purpose of this chapter is to fill this gap in the literature by providing a systematic analysis of economies of scale, economies of scope and productivity growth of the Chinese banking industry with the aid of a quarterly micro panel dataset. In so doing, it makes three substantial contributions to the literature.

First, it investigates the efficiency of the Chinese banking sector, which is dominated by four state-owned commercial banks (SOCBs) that are widely believed to be plagued with efficiency problems (e.g. Lardy, 2000; Aziz and Duenwald, 2002; Allen et al, 2006). However, the existing empirical work has sought to gauge the extent of the problems by considering difficulties related to loan issuance such as non-performing loans (NPLs) only. This chapter offers an explicit analysis on Chinese banks' cost efficiency and productivity performance, and sheds some light on the mechanisms that contribute to the banks supposed inefficiency.

Second, this is among the first studies to investigate the role of ownership structure in the efficiency of the Chinese banking industry. Specifically, the performance of the SOCBs is compared with that of the joint stock commercial banks (JSCBs) in terms of cost efficiency and productivity growth. This would therefore inform the ongoing policy debate, especially provide an indication as to where the strength of the private sector might lie. This is a timely exercise as China is committed to liberalising its financial sector following its accession to the World Trade Organisation (WTO) in 2001.

The third contribution of this chapter is a careful examination of the appropriateness of a popular cost function, namely, a multiple output translog cost function, as a framework for analysing banking efficiency in China. In this respect, it is hoped that this work would provide a useful starting point for future researchers using similar banking data for China.

Four key results emerge from the analysis: (i) The fixed effects translog cost function is not concave in input prices at 330 data points out of 378. This suggests the need to impose concavity on the cost function prior to estimation; (ii) The JSCBs enjoy economies of scale in 90% of the cases, whereas all the SOCBs exhibit significant diseconomies of scale, which is

mainly due to high operating cost; (iii) There are no sizeable economies of scope amongst the JSCBs, and a larger proportion of the SOCBs display diseconomies of scope. This indicates that the existing product diversification strategy has not delivered cost efficiency; and (iv) The productivity growth performance of the Chinese banks, including the JSCBs, leaves a lot to be desired. This suggests that the strength of the JSCBs in China lies in their superior cost efficiency compared to state banks, and not in their technical capacity.

The organisation of the remaining sections of the chapter are as follows. Section 2 gives a brief overview of the current banking system in China. Section 3 discusses some estimation issues and Section 4 presents the data. Section 5 provides a discussion of the main findings of this study. Section 6 concludes.

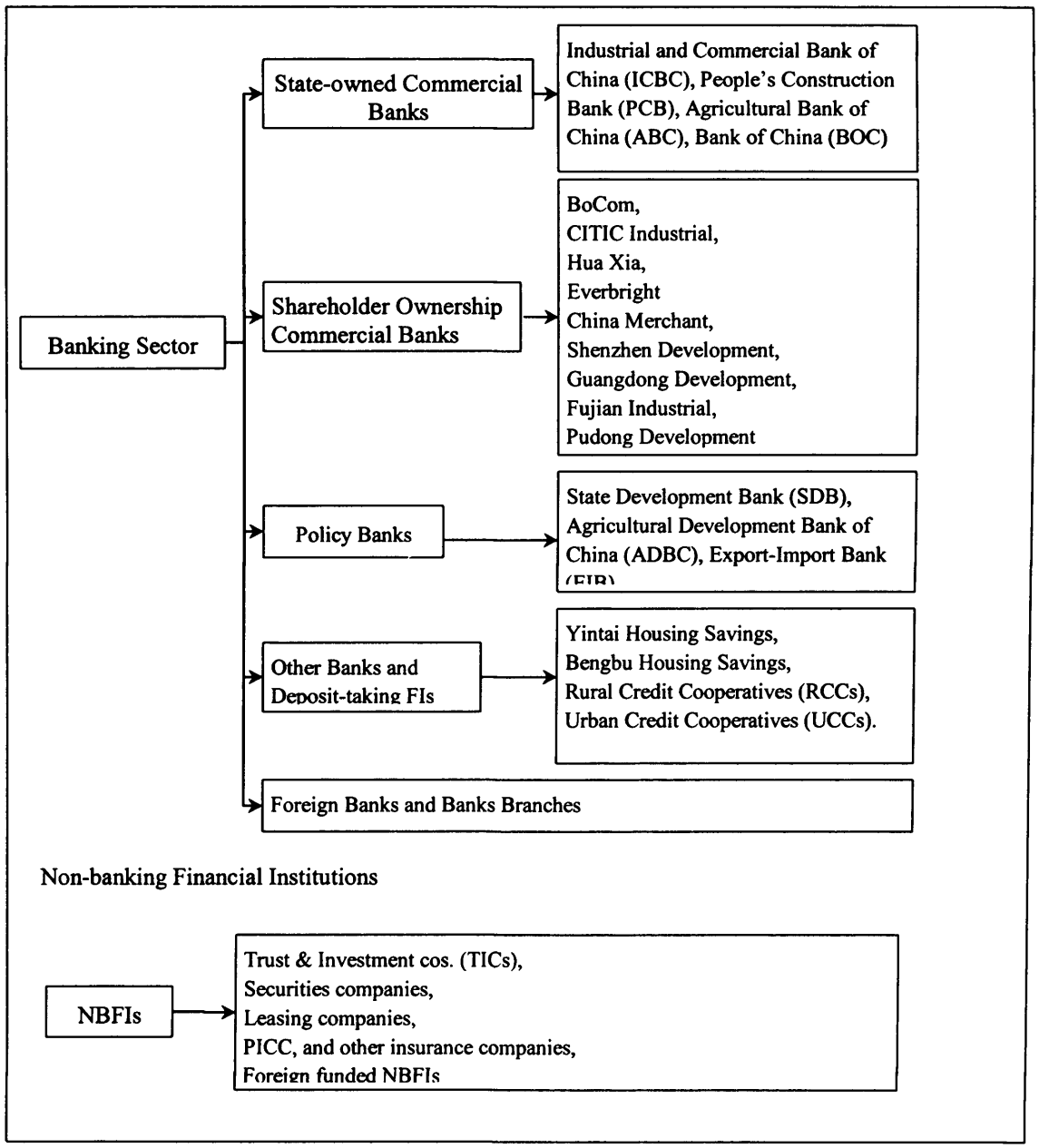
2.2 THE BACKGROUND

The current banking system in China (as illustrated in Figure 1 below) has evolved from a mono-banking system (the People's Bank of China, the PBC) during 1949 and the mid-1980s and a two-tier system (a central bank and four specialized banks[4]) during the mid-1980s and the mid-1990s[5]. There are now five types of banks in China: (i) policy banks, established around 1994 to carry out policy-related businesses most of which were conducted by old state-owned banks; (ii) purely state-owned commercial banks, SOCBs, also known as the "Big Four" [6]; (iii) the JSCBs, which are owned by other organizations and/or the public, not part of the Big Four; (iv) city and rural commercial banks, urban and

[4] The PBC has been the central bank since then on. Four specialised banks were the predecessors of the current four SOCBs.
[5] The historical evolution of the Chinese banking system is reviewed in Xu (1998).
[6] The Big four are the largest banks and major players in the Chinese banking market. The recent survey of the world's 1000 largest commercial banks by *The Banker* (July 2003) included 15 Chinese banks, among which Bank of China, Industrial and Commercial Bank of China, Agricultural Bank of China, and China Construction Bank were ranked 15th, 16th, 25th, and 37th according to core capital reserve. In the new reform agenda, the SOCBs are going public, hence the ownership structure is expected to change considerably.

rural credit cooperatives, providing essential banking services at local level; and (v) foreign banks, which have not yet started RMB[7] retailing business. The SOCBs and the JSCBs have an absolute dominance of the Chinese banking market in terms of total assets, total loans, total deposits, as well as the number of branches and employees. This can be demonstrated by Table 1, in which the Big Four held around 70% of the market share by the end of 2002, while the JSCBs, building banks and city commercial banks had 20% of the market share.

Figure 1: Chinese banking structure (by 2002)



[7] RMB is China' legal tender, meaning the People's currency, and its unit is Yuan. The average exchange rate with USD is around 8:1.

Table 1: Market structure of the banking sector in China by the end of 2002

(Unit: RMBYuan, 100 million)

Types of banks	No. of Banks	No. of branches	No. of employees (thousands)	Total Assets	Market Share (%)	Total deposits	Market Share (%)	Total loans	Market Share (%)
State Owned Bank	4	98,727	1638.4	14.65	71.74	11.84	68.05	8.46	68.78
Policy Bank	3	-	-	1.29	-	-	-	-	-
Share-ownership Commercial Bank	12	4,808	134,044	2.99	14.64	3.39	19.48	2.29	18.62
City Commercial Banks	111	2,590	107,913	1.17	5.73				
Foreign Banks	13	-	-	0.32	1.57	0.07	0.4	0.15	1.22
Cooperatives (Urban & Rural)	-	96,591	701,295	-	-	2.1	12.07	1.4	11.38
Total	141	202,716	944,890	20.42	100	17.4	100	12.3	100

Source: Almanac of China's Finance and Banking (2003).

Note: The average market exchange rate of Chinese RMB Yuan to American dollar is around 8.3/1.

China's financial system has undergone a series of reforms in recent years, especially after the Asian financial crisis in 1997. First, through years the SOCBs have accumulated considerable amount of NPLs, mainly due to defaulting loss-making state-owned enterprises. Although there is no accurate figure about existing NPLs, some estimate that it could be more than 40% of the SOCBs' total loans (see Allen *et al* 2005). The Chinese government established four asset management companies (AMCs) in 1998 to liquidate NPLs. By the end of 2000, about RMB1.1 trillion worth (US$ 134 billion) of NPLs have been transferred to the AMCs, which improved the SOCBs' balance sheets dramatically[8]. Second, measures to reduce redundant labor units and enhance efficiency among SOCBs have been taken. Between 1998 to 2002, the four SOCBs have laid off 250,000 employees and closed 45,000 branches. Third, the government has reduced its interference in SOCBs' operation, enhancing their independence and the degree of transparency. China's Banking Regulatory Commission (CBRC) started operations in April 2003 as an independent body to ensure the legitimacy and functioning of the banking industry. An immediate result was the separation of banking regulation and monetary policy functions of the central bank. Fourth, there is a limited opening up of the financial market to foreign competition, pursuant to China's WTO commitments.

2.3 THE METHODOLOGY

2.3.1 Total cost function specification

Two alternative approaches to analyse cost economies are the cost function and the production function frameworks. Given technological and market constraints, the production

[8] The details of how do AMCs operate are beyond the scope of this thesis. For more on AMCs and NPLs transfer, see Ma and Gung (2002).

function approach usually assumes profit maximization under perfect competition. By contrast, the cost function approach assumes only that organizations choose input bundles that minimise the cost of producing outputs. In the context of the Chinese banking sector, especially for the SOCBs, profit maximisation is a rather stringent assumption, and for this reason, the cost function framework is adopted.

The cost structure, efficiency and production economies can be assessed either non-parametrically by utilising for example linear programming, or parametrically using econometric techniques (see Berger and Mester, 1997, for a detailed survey). Because nonparametric techniques typically focus on technological optimisation rather than economic optimisation and do not allow for random errors, a parametric approach is preferred and adopted in this study.

Several functional forms of the cost function have been used in the literature. Amongst those, the multi-output translog cost function appears to have the most enduring appeal, mainly because of its flexibility (in the sense of approximating arbitrary but theoretically consistent behaviour) and its robustness (see, Hunter *et al*, 1990 and 1995; Lawrence, 1989).

Assuming banks minimise total cost with respect to all inputs, a *total cost function* (TC) can be expressed as $TC = TC(Y, P)$, where Y and P are vectors of output and input prices respectively (the list of outputs and input prices and their definitions are given in detail in Data section 2.4). Ignoring individual bank and time subscripts, the total cost function takes the following form:

$$\ln TC = a + \sum_i b_i \ln y_i + \sum_j c_j \ln p_j + \frac{1}{2}\sum_i \sum_k d_{i,k} \ln y_i \ln y_k + \frac{1}{2}\sum_j \sum_l e_{j,l} \ln p_j \ln p_l +$$
$$\sum_j \sum_i f_{j,i} \ln y_i \ln p_j + h_1 T + \sum_i h_{2,i} \ln y_i T + \sum_j h_{3,j} \ln p_j T, \qquad (1)$$
$$i,k = 1,2,3,4, and j,l = 1,2,3,4,$$

where $lnTC$ is the logarithm of total cost, lny_i is the log of the i^{th} output (i=1,2,3,4) and lnp_j is the log of the j^{th} input price (j=1,2,3,4). T is a quarterly time trend to deal with possible trend and seasonality (T=1,2,..28). The parameters a, b_i, c_j, $d_{i,k}$, $e_{j,l}$, $f_{j,i}$, and h are the coefficients to be estimated. Using Shepard's Lemma (1970), cost shares attributed to the i^{th} input[9] can be obtained as:

$$s_j = \partial \ln C / \partial \ln p_j = c_j + \sum_l e_{jl} \ln(p_l / p_k) + \sum_i f_{j,i} \ln y_i + h_{3,j} T \quad (l \neq k) \qquad (2)$$

Equations (1) and (2) form a system of cost equations and this is the basis of most empirical work in this area.

2.3.2 Regularity conditions

To my knowledge there is no previous application using the above approach to Chinese banking data. In spite of the widespread use of the translog cost function, it is imperative to establish if it is indeed an appropriate framework for analysing cost efficiency issues within the Chinese banking system. This involves ascertaining whether the required theoretical properties of the cost function are supported by the data. Also known as *regularity*

[9] The share equation system possesses adding-up feature, in that for each observation the sum of the dependent variables (the cost shares) over all equations are always equal to unity. In order to avoid the disturbance covariance matrix from being singular and non-diagonal and also to make maximum likelihood (ML) estimation feasible, one of the share equations is dropped. As long as ML estimation procedures are employed on the n-1 share equations, all parameter estimates, log-likelihood values, and estimated standard errors will be invariant to the choices of which n-1 equations are directly estimated. In this case, the first three equations are derived by the fourth one, and eliminate the last row and column of the parameter matrix. More details see for example Ernst (1991, 9.4, pp. 474).

conditions, these theoretical properties include continuity, non-negativity, symmetry, and linear homogeneity in prices, monotonicity in prices and outputs, and concavity in prices[10].

Continuity and non-negativity of the function are satisfied and can be observed through non-discrete and non-negative cost variable. Symmetric conditions and linear homogeneity in input prices are imposed as:

$$d_{i,k} = d_{k,i} \text{ and } e_{j,l} = e_{l,j}, \tag{3}$$

$$\sum_j c_j = 1, \sum_l e_{j,l} = 0, \sum_j f_{j,i} = 0 \tag{4}$$

The translog function ensures global monotonicity in prices, but not in outputs, which relies on the data. The monotonicity condition on the k^{th} output can be checked through:

$$\partial C / \partial y_k = (\partial \ln C / \partial \ln y_k) \cdot (C / y_k) = (b_1 + \sum_i d_{k,i} \ln y_k + \sum_l f_{1,k} \ln p_k) \cdot (C / y_k) + h_{4,k} T \tag{5}$$

where $\partial \ln C / \partial \ln y_k$ is the cost elasticity with respect to each output.

A necessary and sufficient condition for a twice continuously differentiable cost function to be strictly concave in prices is the negative semi-definiteness of the matrix of the second order partial derivatives (i.e. Hessian matrix) with respect to input prices. However, the empirical literature shows that translog cost functions frequently fail to satisfy the concavity condition, resulting in positive own-price elasticity of the input quantities (Jorgenson and Fraumeni, 1981). To deal with curvature violations, one can impose concavity conditions on the cost function. This may be done globally following Diewert and Wales (1987), or locally by employing the method of Ryan and Wales (2000). The downside of imposing concavity is that this might rule out any complementary relationships between the inputs. In that case, the main advantage of a flexible functional form – the ability to represent a wide range of technologies – would be lost (Diewert & Wales, 1987).

[10] The theoretical properties of production function can be found in standard textbooks, for example, Chambers (1988).

2.3.3 Measurement of cost economies

The concept of economies of scale describes the relationship between the scale of operation and its total costs. Economies of scale exist when a proportional increase in factor inputs yields a more than proportional increase in outputs. Following Panzar and Willing (1977), the overall economies of scale (SE) is defined as the inverse of the summation of the cost elasticity of all the outputs, that is

$$SE = C(Y,P) \Big/ \sum_i y_i MC_{yi} = 1 \Big/ \sum_i E_{yi} \qquad (6)$$

where $MC_{y,i}$ is the marginal cost of the i^{th} output, and $E_{y,i} = \partial \ln C / \partial \ln y_i$, is the cost elasticity with respect to the i^{th} output. If $SE > 1$, the cost function exhibits economies of scale, indicating its production function has increasing returns to scale; if $SE < 1$, the cost function exhibits diseconomies of scale, indicating the production function has decreasing RTS, while $SE = 1$ mean scale neutrality and constant returns to scale. However, increasing return to scale is not the only source of economies of scale; they can also arise from the existence of certain set-up costs, that is, the fixed costs occurred at the beginning of production (Ernst, 1994, Chapter 3).

Economies of scope exist when two products (or two product sets) can be produced at a lower cost than two single products or two single product sets, that is,

$$C(Y_1,0) + C(0,Y_2) > C(Y_1,Y_2).$$

The extent of scope economies (SC) can be measured by the relative increase in cost that would result if the output vector were produced by two single products rather than being produced jointly, that is

$$SC = [C(Y_1,0) + C(0,Y_2) - C(Y_1,Y_2)] / C(Y_1,Y_2),$$

where SC>0 (SC<0 and SC=0) suggests the presence of overall scope economies (overall scope diseconomies and scope neutrality). To deal with zero output level in the logarithm form, I follow Kolari and Zardkoohi (1987) who suggest using minimum observed output produced by the bank in each size group[11]. Then, in the four-output case, the increase in total costs due to an increase in a given output (ΔY_i) can be defined as:

$$\Delta C_1 = C(Y_1^{\min} + \Delta Y_1, Y_2^{\min}, Y_3^{\min}, Y_4^{\min}) - C(Y_1^{\min}, Y_2^{\min}, Y_3^{\min}, Y_4^{\min})$$

$$\Delta C_2 = C(Y_1^{\min}, Y_2^{\min} + \Delta Y_2, Y_3^{\min}, Y_4^{\min}) - C(Y_1^{\min}, Y_2^{\min}, Y_3^{\min}, Y_4^{\min})$$

$$\Delta C_3 = C(Y_1^{\min}, Y_2^{\min}, Y_3^{\min} + \Delta Y_3, Y_4^{\min}) - C(Y_1^{\min}, Y_2^{\min}, Y_3^{\min}, Y_4^{\min})$$

$$\Delta C_4 = C(Y_1^{\min}, Y_2^{\min}, Y_3^{\min}, Y_4^{\min} + \Delta Y_4) - C(Y_1^{\min}, Y_2^{\min}, Y_3^{\min}, Y_4^{\min})$$

where the superscripts $^{\min}$ denote the minimum output value in the sample. Along the same line, the increase in cost of producing all the outputs jointly is given as:

$$\Delta C_{1,2,3,4} = C(Y_1^{\min} + \Delta Y_1, Y_2^{\min} + \Delta Y_2, Y_3^{\min} + \Delta Y_3, Y_4^{\min} + \Delta Y_4) - C(Y_1^{\min}, Y_2^{\min}, Y_3^{\min}, Y_4^{\min}).$$

Finally SC can be computed as:

$$SC = \left[(\Delta C_1 + \Delta C_2 + \Delta C_3 + \Delta C_4)/\Delta C_{1,2,3,4}\right] - 1. \qquad (7)$$

2.3.4 Variable cost function assumption

Some argue that it would be more realistic to assume that banks do not minimise total cost, but only costs with respect to some inputs (known as variable inputs). The cost of variable inputs is then conditional on the level of the remaining inputs, which is normally a subset of the inputs that are difficult to adjust (also called quasi-fixed factors). In case of the Chinese

[11] Alternatively Kim (1986) suggests using a reference point 10% of the sample mean output as the substitutes of zero-level output. Kim's 10% reference point is quite arbitrary and disputable, while Kolari and Zardkoohi (1987)'s the minimum output value heavily depends on the data. Both approaches are experimented and Kolari and Zardkoohi (1987)'s approach resulted in more sensible estimates. More specifically, some outputs are quite high in value, there are a few cases even 10% of the sample means remain too high.

banks which operate under a fully or partial state ownership, it may be difficult to freely adjust labour usage and control the corresponding operating expenses. Hence it is reasonable to assume labour inputs to be quasi-fixed factors and only minimize the costs of the rest of the inputs. In this case, a *variable cost function* (VC) is expressed as $VC = VC(Y,P,Z)$, where Y remains output vector; Z refers to the quasi-fixed factor and P is the vector of variable input price.

The variable cost function, like the total cost function, provides all the information required for inferring the structure of production[12], and the cost system in a translog variable cost function form is given as:

$$\begin{aligned}\ln VC = a &+ \sum_i b_i \ln y_i + \sum_j c_j \ln p_j + \frac{1}{2}\sum_i\sum_k d_{i,k} \ln y_i \ln y_k + \frac{1}{2}\sum_j\sum_l e_{j,l} \ln p_j \ln p_l \\ &+ \sum_j\sum_i f_{j,i} \ln p_j \ln y_i + g_1 \ln z + \frac{1}{2} g_2 \ln^2 z + \sum_i g_{3,i} \ln y_i \ln z + \sum_j g_{4,j} \ln p_j \ln z + h_1 T \\ &+ \sum_i h_{2,i} \ln y_i T + \sum_j h_{3,j} \ln p_j T + \sum_j h_{4,j} \ln z T \end{aligned} \tag{8}$$

$$s_j = \partial \ln C / \partial \ln p_j = c_j + \sum_l e_{j,l} \ln(p_j / p_k) + \sum_i f_{j,i} \ln y_i + g_{4,j} \ln z + h_{4,j} T, \tag{9}$$

where z is labour inputs, and rest of the notations are the same with the total cost function as in Equation (1). The regularity conditions for total cost function discussed in section 2.3.2 also apply here.

2.4 THE DATA

A newly available quarterly dataset is employed in this study. The dataset is compiled from several statistical sources including banks' annual reports and financial statements (more exactly, asset and liability statements, and loans and income statements), audit reports of the

[12] See Lau (1976) for the theory, and Caves, Christensen and Swanson (1981) for an application.

listed banks and the BankScope[13]. Fourteen independent commercial banks are included, with four SOCBs and ten JSCBs[14], over the period of the first quarter of 1995 to the fourth quarter of 2001[15].

Table 2 lists the fourteen banks being examined in the chapter, which represent at least 85% of total bank deposits and bank loans in the industry during the sample period. The products and services these banks offer are limited, due to the underdeveloped financial market, and regulation restrictions on banking activities. Hence, loans, deposits, inter-bank borrowing and lending, and investments make up the main product lines. The contribution of off-balance sheet activities to total income is less than 1% during the sample period, and is thus ignored in the analysis.

Table 2: The banks in the sample

Banks	Short Code	Year the bank established
State-owned Commercial Bank (SOCBs)		
Industrial & Commercial Bank of China	ICBC	1985
Bank of China	BOC	1985
Construction Bank of China	CCB	1985
Agricultural Bank of China	ABC	1985
Joint-stock Commercial Bank (JSCBs)		
China Investment Bank	CIB	1991
Bank of Communications	BOComm	1987
China International Trust & Investment Corporation	CITIC	1987
China Everbright Bank	CEB	1992
China Minsheng Banking Corporation Ltd.	MSB	1996
Guangdong Development Bank	GDDB	1991
Shanghai Pudong Development Bank	PDDB	1993
Hua Xia Bank	HXB	1995
Fujian Industrial Bank	FJIB	1991
Shenzhen Development Bank	SHDB	1991
China Merchants Bank	CMB	1992

[13] BankScope is a global banking database as bankscope.bvdep.com.
[14] The sample does not include policy banks due to their peculiar cost structure. City commercial banks, credit cooperatives and foreign banks are also excluded because of their insignificant market share and data unavailability.
[15] With the exception of Everbright bank which only have available data from the third quarter of 1998.

How to measure the productivity of banks is an ongoing debate because of different views on what constitute bank outputs. There are mainly two views: the first, known as the intermediation approach, takes banks as intermediaries that produce loans, securities and other earning assets by using funds, such as deposits and other input. The second, known as the production approach, considers banks as any other firm that uses fixed assets, capital assets and human capital to produce deposits, loans and other services. The intermediary approach is more widely applied because it is less demanding in terms of data requirement (Heffernan, 1996), and hence it is adopted here. In this study, four outputs are identified: short-term loans, long-term loans, investments and securities, and other earning assets, which are produced by four inputs: short-term deposits, long-term deposits, other borrowing and deposits and inter-bank deposits.

Output and input are measured in Chinese RMB Yuan[16]. The total cost is calculated as the sum of interest expenses and operating costs, while interest expenses are considered to be variable costs in the variable cost function. The price of an input is calculated by dividing the expense by its quantity. Table 3 gives the definition and summary statistics of the relevant variables.

[16] As for the measurement of the inputs and outputs, the use of currency volume (value) of the various types of earning assets is analogous to physical units of output of the non-financial firm (see Sealey and Lindley, 1977).

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Table 3: Descriptive statistics of the variables used in the model

(Unit: 100 million RMB Yuan)

Variable	Definition	SOCBs		JSCBs	
		Mean	Std. dev	Mean	Std. dev
TC	Total cost: sum of interest expenses and operating costs	890.94	327.1	37.1	39.55
VC	Variable cost: interest expenses	626.57	330.43	21.73	25.29
P_ST depo. (p_1)	Price of short-term deposits: annual interest expenses on short-term deposits/total short-term deposits	0.018	0.008	0.018	0.008
P_LT depo. (p_2)	Price of long-term deposits: annual interest expenses on long-term deposits/total long-term deposits	0.063	0.036	0.06	0.035
P_others (p_3)	Price of other borrowing and deposits including inter-bank borrowing and deposits, loans borrowed from the PBC and fiscal deposits: annual interest expenses on other borrowing and deposits/total other borrowing and deposits	0.059	0.031	0.054	0.031
P_labour (p_4)	Price of labour: total operating costs*/total number of full-time employees	0.001	0.0002	0.002	0.001
ST loans (y_1)	Short-term loans: the value of total aggregate loans issued for at most one year	8098.55	4272.58	377.57	455.15
LT loans (y_2)	Long-term loans: the value of total aggregate loans issued for longer than one year	3,377.74	2,465.13	58.64	89.88
Investment (y_3)	Investments: the value of total aggregate investments	1,878.11	1,962.19	116.84	136.73
Other loans (y_4)	Other earning assets: all other earning assets mainly inter-bank loans and deposits in the PBC.	2,504.72	1,081.18	205.65	221.22
labour	Labour: total number of full-time employees	400,515	143,020	9,031	13,126

Note 1: All the data are deflated by consumer price index (CPI).

Note 2: * Operating costs are the expenses banks use to maintain their operations, including human capital expenses and other capital expenses. Human capital is made up of wages, salaries and benefits of the employees. The data on wages and salaries are not available, so the operating expenses are used as proxy.

2.5 EMPIRICAL RESULTS

The cost system (1) and (2) or (8) and (9) are estimated in case of total cost or variable cost function. To make the system function empirically, a stochastic framework is specified by adding a random disturbance term to each share equation, and the resulting disturbance vector is assumed normally distributed with mean zero and a constant covariance matrix. Bank-specific fixed-effects are also included to capture unobserved factors specific to individual banks that stay constant over time but may be correlated with the regressors.

2.5.1 The appropriateness of the cost function specification

Table 4 below reports the estimated cost elasticity with respect to each output and the ratio of positive data points. The non-negative elasticity of outputs shows that the monotonicity condition in outputs is largely satisfied. It is noteworthy that short-term and long-term loans are the most and the least elastic output. The percentage change in total cost derived by the percentage change of short-term loans is highest while that derived by the percentage change of long-term loans is lowest.

Table 4: Cost elasticity of outputs

Cost Elasticity of Output	Mean	Std.	Ratio of the data points with positive values
Overall output	0.9961	0.1711	93%
ST loans	0.5612	0.0913	100%
LT loans	0.0516	0.0551	97%
Investment	0.1334	0.0322	100%
Other loans	0.2499	0.1046	100%

The estimates of the implied elasticity of substitution and own price elasticity are derived in Table 5 using the fitted cost shares. The elasticity of own-substitution and implied price elasticity have negative signs suggested by the theory, although the own-elasticity of

other liabilities are not statistically significant. The results suggest almost no substitutability between short-term and long-term deposits or between deposits and labour inputs. There is also evidence of some complementarities between short-term deposits and other liabilities.

Table 5: Elasticity of substitution

		ST Deposits		LT Deposits		Other Liabilities		Labour	
Cost Share	Fitted value	0.1448		0.3532		0.1137		0.3883	
	Actual value	0.1447		0.3528		0.1136		0.389	
Implied elasticity of substitution	ST Deposits	-2.65**	(0.37)						
	LT Deposits	0.83**	(0.04)	-1.01**	(0.23)				
	Other Liabilities	-2.455*	(1.74)	0.04**	(0.81)	3.36	(0.48)		
	Labour	1.056**	(0.03)	0.54**	(0.06)	0.67**	(0.19)	-0.80**	(0.22)
Implied own price elasticity		-0.12**	(0.0)	-0.14**	(0.04)	-0.08	(0.42)	-0.29**	(0.05)

Note: Standard deviations are in parentheses, * significant at 5%; ** significant at 1%.

Note: The (Allen) implied elasticity of substitution for the translog cost function based on equation (1) and (2) are: $\sigma_{ij} = (e_{ij} + S_i S_j)/S_i S_j$, $i, j = 1,2,3.4$, but $i \neq j$;similarly, the self-elasticity of substitution are $\sigma_{ij} = (e_{ij} + S_i^2 - S_i)/S_i^2$, $i = 1,2,3.4$. Note that positive elasticity mean substitutes, and negative elasticities mean complements. The implied price elasticities are $\varepsilon_{ij} = S_j \sigma_{ij}$. More details see Ernest (1991).

Having established that the estimated cost function is monotonic in outputs, the next is to check if it satisfies the concavity condition in input prices. To this end, the Hessian matrix of the total cost function is calculated at each data point. As shown in column (1) of Table 6, 330 out of the 378 data points violate the concavity condition. This suggests that inference based on the estimated coefficients could be quite misleading. Thus, the cost function is re-estimated with imposing global and then local concavity following Diewert and Wales (1987) and Ryan and Wales (1999) respectively. As Table 6 reveals, only 1 data point exhibit violation of concavity when concavity is imposed globally. This figure increases to 14 when concavity is imposed locally.

Table 6: Concavity condition

Model specification	(1) Without imposing concavity condition	(2) Imposing concavity condition globally	(3) Imposing concavity condition locally

Concavity violation points	330 out of 378	1 out of 378	14 out of 378
Overall RTS	1.67 (0.13)	2.05 (0.93)	1.77 (0.49)
Elasticities of Substitution (ST depo. and LT depo.)	0.83**(0.04)	0.99**(0.00)	1.20**(0.02)
Elasticities of Substitution (ST depo. and other liabilities)	-2.455(1.74)	-1.07**(0.23)	-1.73**(0.52)
Elasticities of Substitution (ST depo. and labour)	1.056**(0.03)	1.05**(0.03)	1.06**(0.02)
Own price elasticities (ST depo.)	-0.12**(0.01)	-0.87**(0.13)	-0.39**(0.06)
Own price elasticities (LT depo.)	-0.14**(0.04)	-0.34**(0.02)	-0.30**(0.04)
Own price elasticities (other liabilities)	-0.08(0.42)	-0.08(0.58)	0.85(6.54)
Own price elasticity (Labour)	-0.29**(0.05)	-0.43**(0.04)	-0.23**(0.09)

Note: Standard deviations are in parentheses, * significant at 5%; ** significant at 1%.

Table 6 shows the cost function parameters (to be more precise, linear combinations of parameters) are generated under alternative model specifications. The average RTS are similar under the original model and when concavity is imposed locally, but when concavity is imposed globally, average RTS take the value of 2.05 that seems much higher than that when concavity is imposed locally. The absolute value of the elasticity substitutions and the own price elasticity's are mostly higher in the concavity-imposed models than the original one. Subsequent analysis will be based on the local concavity-imposed fixed-effects model[17].

2.5.2 Cost economies based on total cost function estimation

Table 7 presents the summary statistics of the estimated scale and scope economies, including the proportion of the observations with above scale economies and scope neutrality. The average level of economies of scale is found to be around 1.035 and it is above unity in all years, albeit with a slightly decreasing trend. In 62% of the cases, the Chinese banks enjoy economies of scale. But this is entirely due to the 90% of the JSCBs

[17] For completeness, Appendix 2 and 3 give the estimated coefficients from the original and concavity imposed models under total and variable cost minimisation respectively. Since the cost function is nonlinear in variables, the individual coefficients are not informative on their own.

observations that display economies of scale. By stark contrast, all the SOCBs exhibit significant diseconomies of scale at each sample period.

The estimates of scope economies suggest that on average the Chinese banks do not exhibit economies of scope during the examined period, although the average scope economies are above zero in 1995 and 1996. The absence of sizeable economies of scope indicates that jointly producing the four outputs is more costly than producing each output independently. So on average these banks have not been able to decrease average cost through product diversification. In all years, except 1996, the average scope economies for the SOCBs are below zero, while those for the JSCBs are around 0.0135 with 42% of the observations displaying some economies of scope. This suggests that cost saving through restructuring product mix is slightly more effective for JSCBs than their SOCBs counterparts. However it is worth noting that the average magnitude of the JSCBs' economies of scope has decreased over the sample period, dropping to below zero after 1997.

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Table 7: Economies of scale and scope based on total cost minimisation

Economies of scale (*SE*)

Overall	N	Mean	St. Dev.	SE>1 ratio	SOCBs	N	Mean	St. Dev.	SE>1 ratio	JSCBs	N	Mean	St. Dev.	SE>1 ratio	t-stat of test significance of difference between SOCBs and JSCBs
SE	378	1.0351	0.1868	61.64%	SE	112	0.8224	0.0297	0.00%	SE	266	1.1247	0.1486	87.59%	-23.65***
By year					**By year**					**By year**					
SE_95	52	1.0533	0.2613	53.85%	SE_95	16	0.8053	0.0239	0.00%	SE_95	36	1.1635	0.2422	77.78%	-6.75***
SE_96	52	1.0401	0.2197	59.62%	SE_96	16	0.8059	0.0278	0.00%	SE_96	36	1.1442	0.1838	86.11%	-8.22***
SE_97	52	1.0107	0.1702	61.54%	SE_97	16	0.81	0.0266	0.00%	SE_97	36	1.0999	0.1238	88.89%	-10.19***
SE_98	54	1.0288	0.1671	62.96%	SE_98	16	0.8208	0.0248	0.00%	SE_98	38	1.1164	0.1147	89.47%	-11.17***
SE_99	56	1.0447	0.1678	64.29%	SE_99	16	0.828	0.0262	0.00%	SE_99	40	1.1314	0.1118	90.00%	-11.65***
SE_00	56	1.037	0.1647	64.29%	SE_00	16	0.8355	0.026	0.00%	SE_00	40	1.1177	0.1211	90.00%	-10.08***
SE_01	56	1.031	0.1446	64.29%	SE_01	16	0.8515	0.0245	0.00%	SE_01	40	1.1028	0.1036	90.00%	-10.41***

Economies of Scope (*SC*)

Overall	N	Mean	St. Dev.	SC>0 ratio	SOCBs	N	Mean	St. Dev.	SC>0 ratio	JSCBs	N	Mean	St. Dev.	SC>0 ratio	t-stat of test significance of difference between SOCBs and JSCBs
SC	378	-0.0666	0.22	35.71%	SC	112	-0.2569	0.21	19.64%	SC	266	0.0135	0.18	42.48%	-12.71***
By year					**By year**					**By year**					
SC_95	52	0.1356	0.15	71.15%	SC_95	16	-0.0267	0.05	37.50%	SC_95	36	0.2078	0.13	86.11%	-7.36***
SC_96	52	0.253	0.13	100.00%	SC_96	16	0.1256	0.06	100%	SC_96	36	0.3097	0.1	100.00%	-6.96***
SC_97	52	-0.1175	0.14	26.92%	SC_97	16	-0.2966	0.05	0.00%	SC_97	36	-0.0378	0.07	38.89%	-13.46***
SC_98	54	-0.1589	0.17	22.22%	SC_98	16	-0.3893	0.08	0.00%	SC_98	38	-0.0619	0.08	31.58%	-13.73***
SC_99	56	-0.1818	0.17	14.29%	SC_99	16	-0.433	0.05	0.00%	SC_99	40	-0.0813	0.07	20.00%	-18.45***
SC_00	56	-0.1691	0.16	14.29%	SC_00	16	-0.3854	0.07	0.00%	SC_00	40	-0.0825	0.08	0.00%	-13.26***
SC_01	56	-0.1973	0.14	7.14%	SC_01	16	-0.3929	0.04	0.00%	SC_01	40	-0.119	0.08	10.00%	-13.44***

Note 1: SE>1 (SE<1) indicates economies (diseconomies) of scale; SC>0 (SC<0) indicates economies (diseconomies) of scope.
Note 2: All estimates are statistically significant at 99% level (with tabulated t-value 2.32).
Note 3: The differences between measures of the SOCBs and the JSCBs are significant at 1% significance level for overall sample and each year. The t-statistics of the significance test of the difference are calculated as $t = (m_{s1} - m_j) / \left(\hat{\sigma} \sqrt{\frac{1}{n_{s1}} + \frac{1}{n_j}} \right)$, where ms and mj are the sample means and ns and nj are the numbers of the sample observations. The estimate of the standard deviation of the population can be obtained by $\hat{\sigma} = \left(1/(n_s + n_j - 2)\right) \left\{ \sum_s (x - m_s)^2 + \sum_j (x - m_j)^2 \right\}$. The t-statistics follows the t distribution with degree of freedom of $\nu = n_s + n_j - 2$.

2.5.3 Cost economies based on variable cost function estimation

Table 8 reports scale economies based on the estimates from the concavity-imposed variable cost function. Recall that in the variable cost function, labour is assumed to be a quasi-fixed input. The results show that on average banks exhibit increasing economies of scale, but with a tendency of decreasing scale economies over time. This overall pattern is consistent with the findings from the total cost function estimates. However, as a contrast, the SOCBs now exhibit significant economies of scale (with SE being 1.59 on average and 100% observations above unit). This suggests that high level of labour costs might be the reason why the SOCBs displayed significant diseconomies of scale in total cost function estimation. The Chinese SOCBs are known to have excessive number of branches and labour usage, and the results presented here support the ongoing policy of reducing the number of branches and redundant labour.

The estimates of economies of scope from the variable cost function are similar to those obtained from the total cost function. They show that, on average, the banks display diseconomies of scope. This again indicates that product diversification did not pay off particularly well, as far as reducing cost is concerned. This might be because the existing product mix of the Chinese banks is rather basic – consisting of only standard items such as short and long-term loans. Other reasons of diseconomies of scope may have been the lack of managerial resources, inadequate labour skill or institutional barriers. In order to take advantage of economies of scope, banks should expand their scope of products and services, such as developing their off-balance sheet business which is currently negligible in terms of revenue generation, along side improving management efficiency and labour quality.

Table 8: Economies of scale estimates based on variable cost minimisation

Economies of scale (*SE*)

Overall	N	Mean	St. Dev.	SE>1 ratio	SOCBs	N	Mean	St. Dev.	SE>1 ratio	JSCBs	N	Mean	St. Dev.	SE>1 ratio	t-stat of the significance test of difference between SOCBs and JSCBs
SE	378	1.305	0.273	92%	SE	112	1.587	0.264	100%	SE	266	1.187	0.171	89%	17.89***
By year					**By year**					**By year**					
SE_95	52	1.544	0.342	100%	SE_95	16	1.88	0.343	100%	SE_95	36	1.395	0.215	100%	6.37***
SE_96	52	1.436	0.279	100%	SE_96	16	1.748	0.251	100%	SE_96	36	1.297	0.147	100%	8.42***
SE_97	52	1.336	0.227	100%	SE_97	16	1.622	0.152	100%	SE_97	36	1.208	0.106	100%	11.50***
SE_98	54	1.293	0.235	93%	SE_98	16	1.587	0.158	100%	SE_98	38	1.169	0.124	89%	10.48***
SE_99	56	1.248	0.232	86%	SE_99	16	1.554	0.123	100%	SE_99	40	1.125	0.128	80%	11.45***
SE_00	56	1.183	0.181	91%	SE_00	16	1.42	0.131	100%	SE_00	40	1.089	0.088	88%	11.20***
SE_01	56	1.126	0.141	77%	SE_01	16	1.296	1.107	100%	SE_01	40	1.058	0.083	68%	2.19***

Economies of scope (*SC*)

Overall	N	Mean	St. Dev.	SC>1 ratio	SOCBs	N	Mean	St. Dev.	SC>1 ratio	JSCBs	N	Mean	St. Dev.	SC>1 ratio	t-stat of the significance test of difference between SOCBs and JSCBs
SC	378	-0.772	0.1412	0.00%	SC	112	-0.886	0.0637	0.00%	SC	266	-0.724	0.1372	0.00%	-12.45***
By year					**By year**					**By year**					
SC_95	52	-0.679	0.2265	0.00%	SC_95	16	-0.776	0.0416	0.00%	SC_95	36	-0.636	0.2604	0.00%	-2.39***
SC_96	52	-0.698	0.1219	0.00%	SC_96	16	-0.834	0.0309	0.00%	SC_96	36	-0.637	0.0946	0.00%	-8.69***
SC_97	52	-0.758	0.1034	0.00%	SC_97	16	-0.872	0.0201	0.00%	SC_97	36	-0.707	0.0823	0.00%	-8.63***
SC_98	54	-0.776	0.1018	0.00%	SC_98	16	-0.899	0.0196	0.00%	SC_98	38	-0.725	0.0735	0.00%	-10.07***
SC_99	56	-0.788	0.1098	0.00%	SC_99	16	-0.922	0.013	0.00%	SC_99	40	-0.734	0.081	0.00%	-10.23***
SC_00	56	-0.826	0.1073	0.00%	SC_00	16	-0.943	0.0094	0.00%	SC_00	40	-0.778	0.0908	0.00%	-8.18***
SC_01	56	-0.865	0.0796	0.00%	SC_01	16	-0.956	0.0083	0.00%	SC_01	40	-0.829	0.0644	0.00%	-8.79***

The notes of Table 7 apply here.

2.5.4 Alternative measurements of scale economies and productivity growth

For multiple outputs variable cost functions, Caves, Christensen and Swanson (1981) provide an alternative measure of scale economies and productivity growth. Productivity growth is defined as the output growth rate (PGY) at which all outputs grow over time holding inputs fixed. Alternatively it is the rate at which all inputs can be decreased over time with outputs fixed (PGX). The link between PGY and PGX is the degree of returns to scale (RTS), which is the proportional increase in all outputs resulting from a proportional increase in all inputs. To be more precise,

$$PGY = RTS \cdot PGX . \tag{10}$$

PGY and PGX are equivalent if and only if RTS=1, when the production function exhibits constant returns. Using the notation of Section 2.3, these measures can be derived as:

$$RTS = [1-(\partial \ln VC / \partial \ln z)]/(\partial \ln VC / \partial \ln Y) = [1-(\partial \ln VC / \partial \ln z)]/\sum(\partial \ln VC / \partial \ln y_i); \tag{11}$$

$$PGY = (\partial \ln VC / \partial T)/(\partial \ln VC / \partial Y) = -(\partial \ln VC / \partial T)/\sum(\partial \ln VC / \partial \ln y_i); \tag{12}$$

$$PGX = -(\partial \ln VC / \partial T)/[1-(\partial \ln VC / \partial z)]. \tag{13}$$

Table 9 reports the estimated RTS and productivity growth. The RTS estimates are on average greater than one, indicating that overall the banks have increasing returns to scale, consistent with the results of economies of scale under the variable cost assumption. Productivity growth measures are mostly below zero during the examined period. This indicates that the outputs have been decreasing over time holding inputs constant, and inputs have been increasing over time holding output constant. However, the extent of the overall productivity growth, that is, the absolute values of PGY and PGX, have been decreasing over time, approaching zero by the end of the period. Productivity growth reaches its peak towards the end of 1999, with the JSCBs exhibiting positive productivity growth for the first

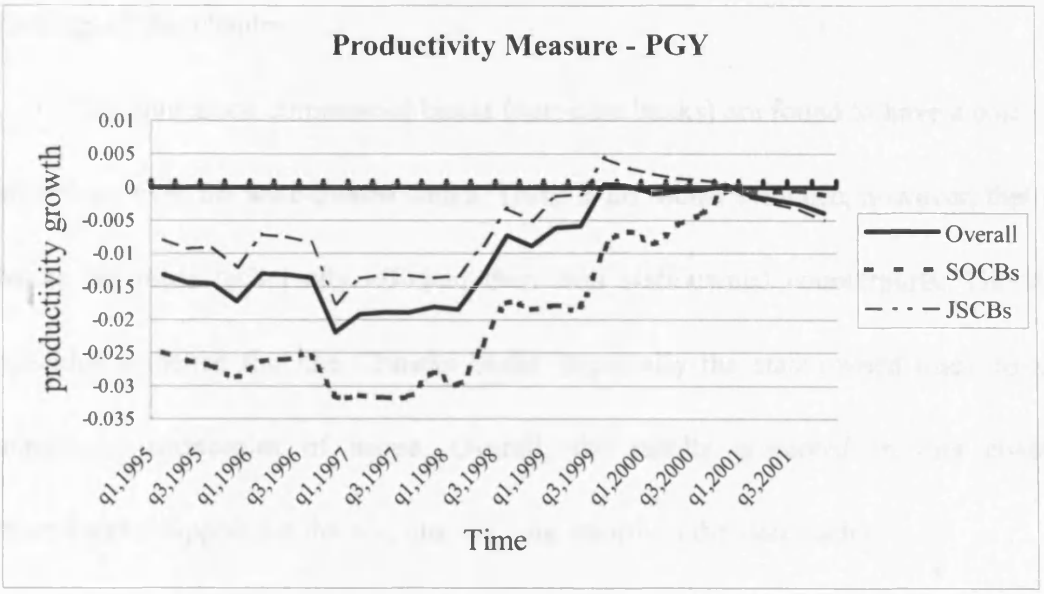
time in the sample period. Figure 2 depicts this trend in productivity growth recovery based on PGY estimates. The surge in productivity growth in most quarters during 1999-2000 coincides with the timing of the large scale of laid-offs and branches cutting-downs. But this growth was not sustained as indicated by the productivity slowdown in subsequent quarters.

Table 9: Productivity growth (PGY, PGX) and returns to scale (RTS)

Overall				SOCBs				JSCBs			
	N	Mean (%)	SD		N	Mean (%)	SD		N	Mean (%)	SD
PGY (Productivity Growth in Output: output growth rate holding inputs constant)											
PGY	378	-0.009	0.014	PGY	112	-0.018	0.017	PGY	266	-0.006	0.011
PGY_95	52	-0.015	0.018	PGY_95	16	-0.027	0.022	PGY_95	36	-0.010	0.012
PGY_96	52	-0.015	0.016	PGY_96	16	-0.027	0.018	PGY_96	36	-0.010	0.012
PGY_97	52	-0.019	0.014	PGY_97	16	-0.031	0.012	PGY_97	36	-0.013	0.011
PGY_98	54	-0.012	0.013	PGY_98	16	-0.022	0.012	PGY_98	38	-0.007	0.010
PGY_99	56	-0.003	0.011	PGY_99	16	-0.013	0.010	PGY_99	40	0.001	0.008
PGY_00	56	0.000	0.009	PGY_00	16	-0.005	0.008	PGY_00	40	0.001	0.009
PGY_01	56	-0.002	0.008	PGY_01	16	-0.001	0.006	PGY_01	40	-0.003	0.008
PGX (Productivity Growth in Input: input decreasing rate holding output constant)											
PGX	378	-0.007	0.011	PGX	112	-0.012	0.012	PGX	266	-0.004	0.009
PGX_95	52	-0.010	0.012	PGX_95	16	-0.017	0.014	PGX_95	36	-0.007	0.010
PGX_96	52	-0.011	0.011	PGX_96	16	-0.018	0.012	PGX_96	36	-0.007	0.010
PGX_97	52	-0.014	0.010	PGX_97	16	-0.022	0.007	PGX_97	36	-0.011	0.009
PGX_98	54	-0.009	0.010	PGX_98	16	-0.016	0.008	PGX_98	38	-0.006	0.009
PGX_99	56	-0.002	0.008	PGX_99	16	-0.009	0.007	PGX_99	40	0.001	0.007
PGX_00	56	0.000	0.007	PGX_00	16	-0.003	0.006	PGX_00	40	0.001	0.008
PGX_01	56	-0.002	0.006	PGX_01	16	0.000	0.005	PGX_01	40	-0.002	0.007
RTS (Return to Sale)											
RTS	378	1.283	0.125	RTS	112	1.389	0.113	RTS	266	1.238	0.100
RTS_95	52	1.367	0.183	RTS_95	16	1.465	0.178	RTS_95	36	1.324	0.170
RTS_96	52	1.308	0.144	RTS_96	16	1.417	0.135	RTS_96	36	1.260	0.121
RTS_97	52	1.263	0.102	RTS_97	16	1.376	0.084	RTS_97	36	1.213	0.060
RTS_98	54	1.268	0.109	RTS_98	16	1.389	0.085	RTS_98	38	1.217	0.070
RTS_99	56	1.274	0.113	RTS_99	16	1.411	0.067	RTS_99	40	1.219	0.075
RTS_00	56	1.264	0.089	RTS_00	16	1.364	0.075	RTS_00	40	1.224	0.058
RTS_01	56	1.240	0.063	RTS_01	16	1.298	0.060	RTS_01	40	1.217	0.047

Note: PGY, PGX and RTS are calculated using equations (11)-(13).

Figure 2: Trend in productivity growth



Overall the productivity growth performance of the Chinese banks, including the non-state banks, leaves a lot to be desired. This suggests that privatisation alone is unlikely to foster technical efficiency and hence the long term performance of the domestic banking industry. On the basis of the results presented in this chapter, the strength of the JSCBs in China appears to lie in their superior cost efficiency compared to the state banks. Whether the seemingly inevitable opening up of the financial sector to international competition is going to overhaul the technical capacity of the domestic banking system remains to be seen.

2.6 SUMMARY AND CONCLUSIONS

This study undertook a more detailed microeconometric analysis of the Chinese banking sector than other studies so far in the literature. A newly available quarterly banking data over the period of 1995 to 2001 has been used to this end. The time span of the data corresponds to a period in which the Chinese banking industry had experienced some

important transformations, and this fact should be borne in mind when considering the findings of this chapter.

The joint stock commercial banks (non-state banks) are found to have a cost efficiency advantage over the state-owned banks. There is no robust evidence, however, that non-state banks are more technically efficient than their state-owned counterparts. The study also provides evidence that the Chinese banks, especially the state-owned ones do not enjoy significant economies of scope. Overall, the results presented in this chapter offer econometric support for the ongoing banking reform in the state sector.

A caveat of the analysis presented in this chapter is that it is based on consolidated bank accounts. Yet many of the banks, especially the big state-owned ones, have branches in different economic regions of China and aggregate bank level data may mask substantial regional heterogeneity in performance. Data permitting, it would be interesting to investigate the extent of intra-bank performance differentials, and examine if banking efficiency is systematically related to the degree of regional development and liberalisation. This would help design more targeted policies aiming at enhancing the efficiency of the financial sector. I will touch upon this issue of regional variation in the next chapter, where the efficiency of the financial system in China will be evaluated from a different angle.

APPENDIX

Appendix Table 1: Total cost function estimation

	Fixed-effects		Concavity imposed			Fixed-effects		Concavity	
lny1	0.633	(5.23)**	0.36	(9.02)**	Inp1lny1	-0.036	(6.15)**	-0.007	(1.12)
lny2	0.045	(1.24)	0.001	(0.7)	Inp1lny2	-0.001	(0.7)	-0.001	(0.62)
lny3	0.344	(4.23)**	0.355	(5.61)**	Inp1lny3	0.012	(2.41)*	0.000	(0.02)
lny4	-0.334	(2.96)**	-0.004	(1.01)	Inp1lny4	0.014	(2.12)*	-0.002	(0.91)
lnp1	0.282	(14.19)**	0.373	(6.07)**	Inp2lny1	0.014	(1.51)	-0.000	(0.02)
lnp2	0.005	(0.2)	0.362	(4.45)**	Inp2lny2	-0.01	(5.29)**	-0.005	(1.08)
lnp3	-0.038	(2.03)*	0.113	(1.64)	Inp2lny3	-0.003	(0.36)	-0.007	(0.95)
lnp4	0.751	(36.93)**	0.152951	(0.000)	Inp2lny4	0.013	(1.27)	0.000	(0.86)
Slny1	0.219	(4.41)**	0.004	(0.96)	Inp3lny1	-0.011	(1.3)	0.000	(0.200)
Slny2	0.000	(0.19)	0.008	(4.17)**	Inp3lny2	0.002	(1.36)	0.028	(4.17)**
Slny3	0.121	(3.50)**	0.009	(1.1)	Inp3lny3	-0.026	(3.68)**	-0.062	(4.10)**
Slny4	0.205	(3.51)**	0.000	(0.58)	Inp3lny4	0.046	(4.87)**	0.036	(4.20)**
Slnp1	0.079	(4.46)**	-0.036	-	Inp4lny1	0.033	(3.42)**	0.008	-
Slnp2	0.100	(3.83)**	-0.020	-	Inp4lny2	0.009	(4.05)**	-0.022	-
Slnp3	0.08	(4.90)**	-0.015	-	Inp4lny3	0.017	(2.08)*	0.070	-
Slnp4	0.076	(6.98)**	-0.0003	-	Inp4lny4	-0.074	(6.72)**	-0.033	-
Inp1lnp2	-0.016	(0.83)	0.0001	-	T	0.151	(4.28)**	0.000	(0.58)
Inp1lnp3	-0.050	(4.60)**	-0.0002	-	Tlny1	0.002	(1.00)	0.001	(1.07)
Inp1lnp4	0.114	(3.96)**	0.0363	-	Tlny2	0.000	(0.07)	0.000	(0.87)
Inp2lnp3	-0.022	(1.43)	-0.006	(2.07)*	Tlny3	-0.011	(4.60)**	-0.006	(4.74)**
Inp2lnp4	-0.185	(5.77)**	-0.007	(1.68)	Tlny4	0.009	(3.25)**	0.000	(0.9)
Inp3lnp4	0.028	(2.04)*	0.013	(1.92)	Tlnp1	0.07	(4.64)**	-0.012	(7.47)**
Iny1lny2	0.036	(3.31)**	0.000	(0.19)	Tlnp2	-0.064	(4.66)**	0.000	(0.7)
Iny1lny3	-0.137	(4.45)**	0.000	(0.51)	Tlnp3	0.012	(2.30)*	0.000	-0.99)
Iny1lny4	-0.191	(4.16)**	0.000	(0.11)	Tlnp4	0.003	(1.89)	0.004	(3.05)**
Iny2lny3	-0.011	(2.14)*	-0.006	(2.07)*	Constant	3.27	(14.3)**	2.049	(8.99)**
Iny2lny4	-0.028	(3.36)**	-0.007	(1.68)	Joint-significance	chi2(12)= 1393.49; Prob>		chi2(12)= 898.21; Prob> chi2 = 0.00	
Iny3lny4	0.051	(1.47)	0.013	(1.92)	Obs	378		378	
					Adj. R^2	98.8%		-	

Note 1: t values are in parentheses; * significant at 5%; ** significant at 1%;
Note 2: A joint significance test is conducted and confirms that flexible cost function is superior to the Cobb-Douglas functional form;
Note 3: The fixed-effect estimation with concavity condition imposed is applied by the system of non-linear equations; hence R^2 is not necessarily appropriate;
Note 4: The missing coefficients are due to the restrictions imposed to achieve concavity.

Appendix Table 2: Variable cost function estimation

	Fixed-effects model		Concavity imposed			Fixed-effects model		Concavity imposed	
lny1	0.201	(0.95)	0.214	(2.66)**	lny1lnz	0.100	(2.41)*	-0.001	(0.94)
lny2	-0.117	(1.85)	-0.058	(2.20)*	lny1T	0.019	(4.94)**	0.008	(4.37)**
lny3	0.237	(1.91)	0.000	(0.32)	lny2lny3	-0.002	(0.43)	0.000	(0.26)
lny4	0.487	(2.99)**	0.412	(6.06)**	lny2lny4	-0.021	(2.34)*	0.001	(0.68)
lnp1	0.742	(17.79)**	0.001	(0.46)	lny2lnz	0.002	(0.19)	0.009	(2.64)**
lnp2	0.156	(2.87)**	-0.009	(0.46)	lny2T	-0.001	(1.06)	0.000	(0.91)
lnp3	0.102	(2.35)*	0.008	-	lny3lny4	0.015	(0.40)	0.000	(0.02)
lnz	0.108	(0.34	0.092	(2.37)*	lny3lnz	0.044	(1.75)	0.005	(1.51)
T	0.054	(2.92)**	0.172	(7.26)**	lny3T	-0.002	(0.53)	0.004	(2.57)*
Slnp1	0.214	(8.20)**	-0.826	-	lny4lnz	-0.096	(3.26)**	0.018	(1.79)
Slnp2	0.212	(4.69)**	-0.174	-	lny4T	0.002	(0.54)	-0.001	(1.22)
Slnp3	0.310	(6.44)**	-0.0016	-	lnzT	-0.013	(4.91)**	-0.008	(6.24)**
Slnz	-0.015	(0.31)	0.000	(0.59)	lnp1lny1	-0.028	(2.89)**	0.02	(1.39)
Slny1	-0.038	(0.48)	-0.007	(0.82)	lnp1lny2	0.004	(2.24)*	0.000	(0.31)
Slny2	-0.006	(2.65)**	-0.001	(1.13)	lnp1lny3	0.023	(3.27)**	-0.046	(2.67)**
Slny3	0.088	(2.32)*	-0.004	(1.1)	lnp1lny4	-0.010	(1.02)	-0.003	(1.07)
Slny4	0.159	(2.53)*	-0.081	(2.93)**	lnp2lny1	0.037	(2.72)**	0.000	(0.14)
lnp1lnp2	-0.152	(4.80)**	0.000	-	lnp2lny2	-0.01	(4.27)**	-0.001	(0.27)
lnp1lnp3	-0.082	(2.67)**	-0.826	-	lnp2lny3	-0.004	(0.42)	0.002	(0.43)
lnp1lnz	-0.013	(2.33)*	0.000	(0.84)	lnp2lny4	-0.026	(2.01)*	0.068	(3.84)**
lnp1T	-0.001	(2.11)*	0.046	(4.88)**	lnp3lny1	-0.008	(0.57)	-0.02	-
lnp2lnp3	-0.03	(0.94)	0.1739	-	lnp3lny2	0.006	(2.38)*	0.001	-
lnp2lnz	0.017	(2.33)*	0.010	(1.18)	lnp3lny3	-0.019	(1.78)	0.0044	-
lnp2T	0.003	(2.69)**	-0.015	(2.42)*	lnp3lny4	0.036	(2.48)*	-0.0065	-
lnp3lnz	0.034	(2.96)**	0.034	(2.86)**	Constant	1.183	(1.04)	0.003	(0.57)
lnp3T	0.013	(3.85)**	0.000	(0.83)	Joint-significance test of Bank Dummy	chi2(12)=1693.49; Prob> chi2 = 0.00.		chi2(12)= 975.04; Prob> chi2 = 0.00	
lny1lny2	0.046	(2.57)*	-0.001	(0.64)	Obs	378		378	
lny1lny3	-0.156	(3.89)**	-0.001	(0.95)	Adj. R^2	93.6%		-	
lny1lny4	-0.042	(0.73)	0.023	(1.61)	Concavity violation	378(/378)		8(/378)	

Notes of Appendix Table 1 apply here.

CHAPTER THREE: CAPITAL STRUCTURE AND FIRM GROWTH IN CHINA

3.1 INTRODUCTION

The previous chapter has investigated the cost efficiency of the Chinese banking industry. In this chapter I explore the extent to which financial resources are employed productively by firms in Chinese manufacturing industry. In particular, I seek to answer the following two research questions: (i) does the source of finance in a firm's capital structure matter for growth? For example, is finance from private sources more efficient than that from public sources in promoting firms' growth? (ii) Do firm characteristics, such as ownership structure, size and location, mediate the relationship between access to finance and performance?

There are a number of reasons, both academic and policy related, why these questions are worth investigating. First, one of the most severe challenges facing Chinese policy makers is the reform of the domestic banking system. Due to the absence of a primary capital market for a long period, domestic bank loans have been the most important source of external financing for Chinese firms. Yet anecdotal and qualitative evidence suggests that the state-banking sector is riddled with severe problems, including suboptimal resource allocation (Boyreau-Debray, 2005), large amount of non-performing loans and high overhead costs (Allen *et al*, 2005)[18]. Unfortunately, systematic analyses that quantify the extent of the resource misallocation have been few and far between. This chapter aims at enriching the literature by presenting a careful econometric investigation how firms' growth performance is affected by financing sources, which in the case of China, are domestic bank loans, state direct finance and other private means.

Second, following China's accession to the World Trade Organisation (WTO) in 2001, China is committed to open hitherto closed sectors such as banking and finance to

18 Also recall that Chapter two of this thesis also finds robust evidence suggesting that state-owned commercial banks are less cost efficient than their non-state counterparts.

foreign and domestic private investors. In this connection, it is important to evaluate the relative efficiency of foreign and domestic means of finance, and identify the type of firms that are most likely to benefit from foreign finance.

Third, it seems that a consensus has been reached among economists that a well-developed financial system is necessary for growth (see Levin, 2005 for a review of the literature). However, Allen et al (2005) appear to raise China as an important counterexample where, despite the lack of access to formal financing channels and weak legal protection, the private sector is driving its phenomenal growth. Based on the findings from case studies and limited micro data, they conjecture that there must exist informal financing channels and corporate governance mechanisms, such as those based on reputation and people's connections, to support the growth of the private sector. The implication of this line of thought is that developing broader markets, which employ alternative funding channels, should be paid more attentions in the policy debate. Given the potential impact of their findings for research in the area and its wider development policy implications, it is essential to conduct a more systematic investigation into the importance of informal financing sources to firm growth.

Fourth, it is now well documented that notwithstanding state subsidies and easy access to bank credits, the majority of Chinese state-owned enterprises (SOEs) are still performing badly (e.g. Lin et al 1998). A detailed microeconometric analysis of the growth and financing pattern of SOEs would provide an insight into an optimal financial structure for SOEs' growth, and thereby inform the policy debate regarding the future direction of enterprise reform in China. This can also be relevant to other economies in similar environments where competition is just emerging and soft budget constraints persist amongst state enterprises.

To answer the questions posed at the outset, I employ an unbalanced panel dataset based on the Annual Reports of Industrial Enterprise Statistics compiled by the National Bureau of Statistics (NBS) of China. The sample consists of more than 166,000 firms

over the period 1999-2002. These firms are estimated to account for nearly 88% of total industrial output[19]. The detailed information contained in the dataset permits an investigation of the relationship between finance and firm growth in greater detail than has been possibly attempted in the literature so far. Several econometric techniques are applied in order to ensure that the results are robust to potential problems of firm heterogeneity, endogeneity of finance variables and selectivity bias.

To give a brief preview of the main results, I find robust evidence that the source of finance matters to firm growth. The econometric estimates based on the whole sample suggest a discernible pecking order of how efficiently different financing channels drive firm growth: this runs in a decreasing order, from foreign finance, to self-raised finance, to domestic bank loans and finally to state budgets. However, further analyses also show that the link between capital structure and firm growth exhibits considerable heterogeneity across ownership structure, firm size groups and locations.

The rest of the chapter is organised as follows. Section 3.2 provides a brief review of the relevant theoretical literature. Section 3.3 assesses the existing literature on finance and growth in China. Section 3.4 presents the empirical model, discusses the econometric issues and describes the data. Section 3.5 reports the main empirical findings and extends to some further sensitivity analyses. Finally Section 3.6 concludes.

3.2 FINANCE AND GROWTH: THEORETICAL CONSIDERATIONS

The economic literature on finance and growth is voluminous. This section is by no means exhaustive. It concerns only the literature pertinent to the research questions in this chapter, focusing on six strands of literature. The first stressed that financial sector development is a robust determinant of economic growth (see Levine, 1997; Rajan and Zingales, 1998 and Levine, 2005 for a comprehensive review). As a distinct example,

[19] This is calculated based on the dataset used in this chapter, together with the aggregate data in Chinese Statistical Yearbook 2003.

China has sustained impressive growth without a well-developed financial system (Allen et al 2005). The second stressed relates to the theories of firms' financial structure in the corporate finance literature (Modiglinai and Miller, 1958; Harris and Raviv, 1991; Marsh, 1982). These theories however are developed in the context of western economic systems, which are not immediately appropriate to provide a realistic framework for studies of Chinese firms. The third strand concerns known as the theory of financial institutions' property rights that has recently been developed in the context of transitional economies (Majumdar, 1996; Majumdar and Chibber, 1999). It is perhaps more relevant to transitional economies but not yet applied to China. This suggests that finance issued by public financial institutions tends to be less efficient than that issued by private financial institutions. The fourth theme concerns theories and empirical evidence of financial constraints and firm's investment behaviour (Mairesse, Hall, and Mulkay, 1999, for a survey). The fifth focuses on firm growth theory in industrial organization, on which I base the empirical models in the following analyses. Finally, the chapter considers job creation and job destruction as discussed in labour economics. Here we consider firm growth measured by firm employment growth.

3.2.1 Growth-promoting finance and the China paradox

The relation between finance and growth has been well established in the literature (for an excellent survey see Levine, 2004). Several channels through which a well-developed financial system can encourage growth are identified in the theoretical literature. First, a financial system conveys information *ex ante* regarding the value of potential investment projects to individual savers. Second, it monitors firms and hence motivates firm managers to ensure that effective corporate governance mechanisms are in place. Third, it allows individual agents to undertake risky projects with high return due to its risk-pooling nature. Fourth, it lowers transaction costs through specialization, technological innovation and growth. Finally, a well-functioning financial system has a positive influence on human capital accumulation. For example, Jacoby (1994) shows how access

to credit facilitates the process of skill upgrading. Given these considerations, it is reasonable to conclude that if the financial system of a country is not functioning well, the allocation of financial resources would be suboptimal and its supposed growth-enhancing effects will not materialise. This view, however, does not seem to apply to China.

Several economists have noted China as a significant counter-example of the finance-growth theory, as it has enjoyed a fast and sustained economic growth without a developed and efficient financial system (Lardy, 2000; Aziz and Duenwald, 2002; Allen *et al*, 2005). There are attempts to solve the paradox. The most influential argument so far is advanced by Allen *et al* (2005), who postulates that China's growth without a well-functioning financial system is evident for the existence of an efficient informal financing channel and corporate governance mechanism, such as those based on reputation and relationships. However the role of the formal and informal financial systems as a catalyst for its growth remains largely under-researched.

3.2.2 Financial structure theories and their inapplicability in the case of China

A firm's capital structure has been a core issue in the modern theory of corporate finance. Since Modiglinai and Miller's theorem (1958) predict that under special circumstances (no tax and perfect financial markets), firm's capital structure does not matter to firm value, many have found this prediction debatable (see Stiglitz, 1988). There has been a quest to explain the stylised fact that firms prefer one type of financing to another. Two prominent theories have emerged in this respect. The first is the static trade-off theory (see Harris and Raviv, 1991, for a review), which suggests that a firm chooses a debt–equity mixture that optimises its value, and the resulting 'optimal capital structure' is determined by trading off the costs and benefits of equity and debt, including tax shields, financial distress, and the agency costs of debt and equity. The second is the pecking order theory (e.g. Donaldson, 1961 and Marsh, 1982), which advocates that firms choose

the type of capital according to some order of preference. This preference means internal finance is preferred to debt, and debt is more favoured than share issues. Recent findings (e.g. De Haan and Hinlloopen, 2003) present evidence in favour of this type of hierarchy in firms' choices of finance.

These dominant financial structure theories are developed for western economies, and are less relevant for developing and transitional economies (Majumdar and Chibber, 1999). This is mainly because a principal assumption of all these theories is that the suppliers of finance are privately owned (more details will be explained in the next section). This however is rarely the case in developing economies such as China. Furthermore, within the Chinese manufacturing sector, listed firms constitute a small minority[20]; hence the capital structure of the majority of firms does not correspond to that assumed in the existing theoretical models. Such theories cannot be applied in the context of China also because such accounting data are not available.

3.2.3 The theory of the property rights of state-owned financial institutions

Majumdar (1996a, 1999) provides another line of theory for transitional economies. It contends that property rights (the rights over the enjoyment and disposal of income streams and assets) are attenuated in state-owned financial institutions (SOFIs) because the market for corporate control is inadequate or absent. The relationships between firms, banks and government are often intertwined and obscure. This induces agency problems, and may result in a negative association between firms' leverage and its performance. More elaborately, this can be seen from three angles. First of all, firms that have borrowed from SOFIs do not feel the need to change the incentive structures to repay the loans, as a result of bonding behaviour (Grossman and Hart, 1986), especially for those with soft-budget constraints (Majumdar, 1996a). Second, SOFIs have reduced incentives

[20] By 2004, there were only 1,337 listed firms in China, which are around 0.6% of total industrial firms (calculation is based on China Statistical Yearbook 2005).

to monitor their debtor firms, because they are unlikely to be punished by their own principal – the government, for making bad loans. Finally, government in theory should exercise monitoring and control, but this is difficult in practice, because the power (or ownership) is normally vested in one government department on behalf of the state, whereas the actual control of the SOFIs lies in the hands of individual civil servants, who are also agencies of the state (Majumdar and Chibber, 1999). Knowing this relationship between SOFIs and government, debtor firms might act in a suboptimal way, leading to negative performance consequences.

The conjecture is that these intertwined problems are relevant to the case of China's financial system, and hence this empirical analysis of this chapter will confront this conjecture to data and test whether finance provided by SOFIs is less effective in fostering firm growth than other channels of finance.

3.2.4 Investment and financial constraints

There is a large literature that investigates how financial factors affect firm's investment decisions. Generally, it is believed that financial factors play an important role in firm's investment decision (Mairesse, Hall, and Mulkay, 1999 for a survey). Most studies find that financial variables (such as cash flow or internal finance) help explain firm's investment spending. This is especially true when a firm is under financial constraints. Further the differences in the effect of financial constraints on investment are found related with the differences between financial systems. Bond et al (2003) use company panel data sets for manufacturing firms in Belgium, France, Germany, and the United Kingdom for the period 1978-1989, and find that cash flow and profits terms appear to be both statistically and quantitatively more significant in the UK, which is a more market-oriented economy, than in the three continental European countries. More recently, Semenov (2006) use a larger sample from 11 OECD countries and find that the sensitivity of investment levels to internally available funds differs significantly across countries,

and is lower in countries with predominantly close bank–firm relationships than in countries with predominantly arm's-length bank–firm relationships. However, they find no relationship of the levels of financial constraints to indicators of overall financial development. This is in line with the view that information and incentive problems in the capital market have important effects on corporate investment, and that close bank–firm relationships can reduce these problems and thus improve the access of firms to external finance.

Research that studies the investment behaviour of firms in transition countries is largely limited to Kongings et al (2003), who examine the impact of internal financial constraints on firm's investment behaviour. They find that firms in relatively well-developed market economies, such as Poland and Czech Republic, are liquidity constrained in their investment decisions. In the least advanced transition countries where access to credit is facilitated through preferential lending under various patterns like Bulgaria and Romania, such constraints are less important and investment becomes less sensitive to internal firm financing. Undoubtedly, external conditions such as the functioning of capital markets and the financing conditions are of crucial importance to achieve firms' strategic restructuring in transition economies.

Another line of research has emphasized property rights in explaining firm's investment behaviour (Jocoby et al 2002; Johnson, McMillan and Woodruff, 2002). Cull and Xu (2005) investigate the issue in the case of China. Using a survey dataset of 2,400 firms in manufacturing and service industry from five regions for the period of 2000 and 2002, they find secure property rights are a significant predictor of firm reinvestment, as well as access to external finance in the form of bank loans, and private ownership. They also provide evidence that access to finance and government expropriation affect small firms more than large ones.

3.2.5 Firm growth theory in the industrial organization literature

The large literature on the theory of firm growth from the industrial organization (IO)

viewpoint is summarized both in standard IO textbooks and in extensive surveys, such as Sutton (1997), Geroski (1999), and Hart (2000). There are also a large number of empirical studies of how firms grow. Examples of such work include see Evans (1987a, 1987b) and Hall (1987) on the United States; Hart and Oulton(1996), Dunne and Hughes (1994) and Geroski (1998) on the United Kingdom; Wagner (1994) among others on Germany; and Harabi (2002) on Switzerland; Holger and Strobl (2005) on Ireland.

These studies have largely assumed firm growth to be determined by firm size and age. Gibrat's law of proportional effect (1931) states that the growth rate of a firm is independent of its current size and its past growth history. More specifically, a firm's growth is proportional to its size and the same growth rate occurs regardless of its initial size. Gibrat's law received supports only from early work, such as Sutton (1997). Recent work supports an inverted U-shaped relationship between firm size and growth (for example, Evans, 1987a; Konings and Xavier, 2002; Carbral and Mata, 2003).

Firm age is an important determinant because the employment adjustment process may also alter as plants move through their life cycle (Davis et al, 1996). Age itself, regardless of start-up period, may influence the growth rate (see, for instance, Dunne & Hughes, 1994; Dunne et al, 1989; Evans, 1987a). On the hand, plants may take some time before they reach their optimal size; on the other hand, long established incumbents may have established cost advantages vis-à-vis newer plants.

Other determinants of firm growth identified in the literature include trade activity and innovation. For instance, in the trade literature export participation and firm performance have been closely linked (see for example Bernard and Jensen, 1999; Baldwin and Gu, 2004). Innovation activity is also documented to drive higher growth (Jovanovic, 1982).

3.2.6 Employment dynamics in labour economics literature

Employment dynamics, as studied in labour economics, are also incorporated in firm

growth literature. The mainstream of this work focuses on the transition economies of Central and Eastern Europe. Konings examined gross job flows with regards to the ownership type and size in Poland (Konings et al, 1996), and employment growth in Romania, Bulgaria, Hungary, Erutku and Vallee (1997). Research on job creation and destruction was also conducted for Russia (Acquisti and Lehmann, 2000) and Slovenia (Vahcic and Petrin 1990). It is common to find that during these transitional economies' restructuring process, large state-owned enterprises were reformed or privatised, deregulation and decentralizations were typically encountered. This resulted in large number of workers losing their jobs and high unemployment has becoming a prominent social and political issue. Meanwhile, numerous small privately owned manufacturers emerged in the market, creating significant job opportunities. In this respect, China may share common features with many transitional economies partly due to their common former socialist economic system.

3.3 GROWTH AND FINANCE IN CHINA

China's financial system is generally considered to be underdeveloped (Lardy, 2000; Aziz and Duenwald, 2002; Allen et al 2005). This notion is essentially based on certain stylised facts regarding the capital markets and the banking industry. China's capital markets are rather small. Compared to LLSV-sample[21] countries in terms of the size of stock markets (measured by the total value traded over GDP and the market capitalization over GDP), China is smaller than most of the countries in the sample. As Table 1 below shows, China's total value traded over GDP is only 0.11 while the sample average is 0.27; its market capitalization over GDP is 0.32 while the sample average is 0.47. This is not surprising, as the two Chinese stock exchange markets were only established in the early 1990s, and by 2004 only 1,337 companies were listed. The stock market has therefore not

[21] LLSV refers to La Porta, Lopez-de-Silanes, Shleifer, Vishny (1998), which is generally used as a reference in cross-country finance and growth studies.

been an important channel of finance for the majority of domestic firms. Apart from being small, China's capital markets lack efficiency, which may have been mainly due to policies (Heilmann, 2002) or due to ineffective regulations (Allen et al, 2005).

The Chinese banking sector has been a major player in the financial system, its well-documented inefficiencies notwithstanding. The fraction of bank credit over stock market capitalization for China is almost four times the corresponding average figure in the LLSV-sample (Table 1). Also as in Allen *et al*'s (2005) cross-country comparison of financial deepening, China's ratio of bank credit to GDP reaches 1.11, much higher than the sample average of 0.73. This is essentially because of its long history in which state-owned banks have a monopoly in the financial market, and the fact that the country has one of the highest saving rates in the world.

Table 1: Allen et al (2005)'s comparison of China's size of financial/banking market with LLSV countries

Measure of financial development	LLSV sample average	China
(1) Total value traded/GDP (%)	0.27	0.11
(2) Market capitalization/GDP	0.47	0.32
(3) Bank credit/GDP (%)	0.73	1.11
(4) Overhead cost/Bank Total Assets (%)	0.03	0.12
(5) Bank credit/Total value traded (%)	2.70	10.09
(6) Number of listed companies	-	1,337

Note: The measures (1)-(4) are from Allen *et al* (2005) Table 3, where LLSV sample includes 49 countries (La Porta, Lopez-de-Silanes, Shleifer, Vishny, 1998). The measure (5) is calculated based on (1) and (3). Most figures are 1999 level, and (6) is 2004 figure.

Chinese manufacturing enterprises are financed from four major sources[22]: state budget appropriations, domestic bank loans, self-raised finance and foreign investment. State budget appropriations refer to the appropriations in the budget of the central and local governments earmarked for capital investment. Domestic bank loans are funds borrowed by enterprises from domestic banks and non-bank financial institutions. Self-raised finance pertains to funds obtained from capital markets, bonds issued by individual

[22] Note this corresponds to the classification of total investment in fixed assets at macroeconomic level (e.g., Statistics Year Book of China 1999, Table 6.3).

enterprises, individual borrowing and funds channelled through local governments, and firms' retained earnings. Finally, foreign investment refers to the capital invested by foreign investors and funds borrowed from foreign sources and managed by domestic state or private enterprises. A typical enterprise tends to use a mixture of all financial sources listed above.

The empirical literature on China's finance and growth is sparse, mostly consisting of studies based on provincial level data or limited firm level data (such as only listed companies). The overall findings suggest that the financial system did not significantly contribute to local economic performance. This disappointing performance is because state finance (mainly through bank credits) has been allocated to regions with high concentration of SOEs (Aziz and Duenwald, 2002), or less productive regions (Boyreau-Debray, 2005)[23], or particularly to large and ailing state-owned enterprises (Shirai, 2002). Neverthless, some researchers report a positive correlation between provincial output growth and the growth of national bank loans and self-raised funds during 1984~1998, with non-state financing sources being more efficient in promoting growth (Liu ad Li, 2001).

Allen *et al* (2005) start by observing that the private sector is at the heart of China's growth[24]. Given that the private sector is heavily discriminated against by the formal financial system, they go on to conjecture that there must exist efficient informal financing channels to support the growth of the private sector. Focusing on the process of reinvestment decisions, Cull and Xu (2005) find that access to finance in the form of bank loans plays an important role in this process. However, their study is confined to domestic bank loans only, and on average less than a third of firms' finance comes from

[23] Boyreau-Debray (2005) focuses on the mobility of capital and the efficiency of capital allocation, and concludes that capital mobility in China is very low and the government tends to allocate capital systematically away from more productive regions.

[24] However, a word of caution here. Allen et al (2005) is based on a survey of 17 entrepreneurs and executives in Zhejiang and Jiangsu provinces only. Both provinces are far advanced in terms of privatization process among 31 provinces in China.

bank loans[25]. Moreover, Cull and Xu (2005) do not address the potential endogeneity of access to finance in firms' reinvestment decisions.

Cull and Xu (2003) examine how government direct transfers and bank loans are allocated to SOEs during 1980~1994. They find a positive relation between bank finance and SOE profitability that does not exist between state transfer and profitability, this link however grows weaker in 1990s than 1980s when SOE bailout responsibilities has shifted from the government to banks. They go on to argue that even in relatively difficult circumstances banks' ability to economize on the costs of gathering and processing information can offer advantages over direct government credit transfer provided there is some incentive for bankers to avail themselves of the information.

In summary, the literature has investigated some aspects of the links between finance and growth in China, but the research in this area is in its infancy. This chapter presents new findings based on robust econometric techniques and a much more representative sample than hitherto employed in the literature.

3.4 EMPIRICAL METHODOLOGY AND DATA

3.4.1 Model specification

In order to discover the role of capital structure that determines firm employment growth, a standard firm growth model is augmented by including finance variables. I hence postulate the following employment growth equation for firms:

$$GROWTH_{it} = \alpha_{it} + \beta' X_{it} + \gamma' FINANCE_{it} + \delta' D_{it} + \varepsilon_{it}, \qquad (1)$$

where for firm i at year t, *GROWTH* is the employment growth rate and X is a vector of control variables (to be discussed below). *FINANCE* is a vector of finance variables, consisting of four financing source variables, state budget appropriations, domestic banks loans, self-raised finance and foreign investments. Each finance variable is measured by

[25] This is the average level calculated based on the data used in this paper during 1999-2002.

its share in total finance to capture a firm's capital structure. The state budget share is the base group in the following analyses.

The inclusion of the control variables (X) are motivated by the firm growth literature in the field of industrial organization and employment turnover. Firm age and size (the total employment at time t) and their squared terms are standard in the literature of the determinants of firm growth and they have been found to have either a negative impact (e.g. Evans, 1987a; Geroski, 1995 and Caves, 1998), or a nonlinear relationship (e.g. Carbral and Mata, 2003) with firm growth. Capital intensity (defined as the growth rate of net fixed assets over total employment) is supposed to affect firm employment growth positively, as more available capital allows firms to expand production scale (e.g. Solow 1956). Total factor productivity (TFP), estimated in the approach of Levinsohn and Petrin (2003)[26], is to test whether firm growth is affected by technological endowment. Following the trade literature that examines the association between export participation (for example Bernard and Jensen, 1999; Baldwin and GU, 2004), knowledge transfer and firm performance, I here include exporting intensity (defined as the share of exports in total sales) in the equation. This is expected to have a positive effect, as the performance-enhancing effects of exports have been widely documented across a number of countries, including China (see Kraay, 1999). Similarly, innovation activity (defined as the share of new product sales) is expected to drive higher growth (cf. Jovanovic, 1982). Following Gort *et al* (1993), labour quality (defined as a firms' wage bill normalized by average wage within the industry, ownership and region cell) is included as a potential determinant of firm growth. The assumption is that for similar firms, differences in average wages reflect differences in labour quality. Finally D is a full set of dummies including firm's ownership, industrial and regional characteristics to capture the fixed effects of firm ownership (there might be different types of firms' growth patterns in terms of employment), industrial characteristics (different industries exhibit different

[26] The details of the methodology see Appendix 1.

production and technology that affect growth pattern) and location (to capture regional differences in labour market and related regional policy). Finally ε is a random error term.

3.4.2 Econometric issues and estimation strategy

Potential endogeneity of finance variables

If a firm's capital structure is correlated with some unobserved factors which also have an impact on its growth performance[27], the issue of endogeneity arises. Recall that in Equation (1) capital structure is defined by a vector of finance share variables, which are truncated variables. To deal with such multiple discrete endogenous variables, I apply a modified control function (MCF) approach due to Wooldridge (2005). Wooldridge (2005) shows that if the baseline model such as Equation (1) is augmented with so-called *correction functions* (CF), then OLS performed on the extended model will deliver consistent estimates of the parameters of interest.

Assume $Finance_j$ (j=1,2,3) are the three truncated finance share variables[28], which have standard Tobit reduced forms:

$$Finance_{ij} = \max\left[0, \vartheta_0' + \vartheta_1' X_i + \vartheta_2' Z_i + \xi_i\right] \qquad (2)$$

where $\xi \mid X, Z \sim$ Normal $(0, \sigma^2)$, and X is the vector of covariates described above and Z is a vector of available instrumental variables, which are assumed to be exogenous and redundant in determining firm growth in the structural conditional expectation. To satisfy these assumptions, the vector Z is constructed to include the following variables: *Political affiliation, SOEs share, Foreign share, SOE Loss Ratio.*

Political affiliation is a set of dummy variables indicating the administrative level at which firms are being "supervised". A significant proportion of Chinese firms (including private firms) are affiliated to some level of government for supervisory purposes. This association with government agencies can help them obtain credit guarantees or collateral

[27] Indeed in Du (2005), there is evidence that financing choices are associated with growth performance.
[28] Recall that the fourth finance variable, share of state budget, is the omitted group in the estimation.

assets that banks demand (see, Huang, 2003)[29]. The instrumental variables *SOEs share* and *Foreign share* are defined as SOEs' and foreign invested firms' market share within the corresponding 3-digit SIC industry and province, and *SOE Loss Ratio* is the share of loss-making SOEs in each industry and province. These three instrumental variables are designed to capture the market and political environments, which influence firms' access to financing sources. For example, in the presence of soft-budget constraints (Lin *et al*, 1998), non-SOE firms in a region and industry with high concentration of SOEs would face relatively more difficulty in getting state budgets and bank loans. By the same token, firms in industries or provinces that are more open to foreign investment can reasonably be assumed to be more likely to get foreign finance. The initial values of all three instruments are used to exclude the possible endogeneity.

Wooldridge (2005) shows that the CF, say $h(X,Z,\theta)$, for models with truncated endogenous variables can be generated as

$$h_j(X,Z,\vartheta)=\sigma^2\cdot\Phi(r\vartheta/\sigma),\ \ r_i\equiv(1,x_i,z_i)\ \text{and}\ \vartheta\equiv(\vartheta_o,\vartheta_1,\vartheta_2),$$

where $\Phi(.)$ is the cumulative normal density. Then Equation (1) can be modified as :

$$\begin{aligned} GROWTH_i &= \alpha+\beta' X_i+\textstyle\sum_j \chi_j' Finance_{ij}+\sum_j \delta_j' Finance_{ij}(X_i-\bar{X}) \\ &+\textstyle\sum_j \rho_j\hat{\sigma}_j^{\,2}\cdot\Phi\left(r_{ij}\hat{\vartheta}_j/\hat{\sigma}_j\right)+\lambda' D_i+\varepsilon_i \end{aligned} \qquad (3)$$

Equation (3) then is estimated by OLS with bootstrapped standard errors to account for the fact that the CF is a generated regressor.

Survivorship or selection bias caused by firm exit

If a firm's growth performance falls below some threshold level, it is likely to go bust, and hence drop out of the data set. Since endogenously determined firm exit raises sample selection issues, it is important to address this when estimating the model based on surviving firms alone. To test and correct for survivorship bias, a firm selection mechanism has is set up. I follow Dunne, Roberts and Samuelson (1989) and Nishimura,

[29] It is noteworthy that political affiliations are normally assigned to firms when they are set up and therefore exogeneous to the error term of the growth process, conditional on X.

Nakajima and Kiyota (2005) by assuming that survival depends on a vector W of exogenous controlling variables: firm age and size (in a nonlinear fashion), productivity level, export participation, innovation activity, ownership, industrial and regional factors. The probability of survival is then modelled using a standard probit function as:

$$Surviving_i = 1\left[W_i'\gamma + v_i\right],\ v \mid W \sim \text{Normal}\ (0,\ 1). \qquad (4)$$

Assuming $(v, \varepsilon) \sim$ bivariate normal $[0,0,1,\sigma_\varepsilon,\rho]$, Heckman's two-step estimation procedure (known as Heckit, 1979) is applied to correct for survivorship bias. This involves (i) estimating the probit selection Equation (4) by maximum likelihood method; (ii) computing the so-called *non-selection hazard* $\hat{\lambda}_i = \phi(W_i'\hat{\gamma}) / \Phi(W_i'\hat{\gamma})$ and (iii) estimating the growth equations by least squares with bootstrap standard errors by including the non-selection hazard term as an additional explanatory variable. A significant non-selection hazard term vindicates the correction for selection bias.

Estimation strategy

As year on year growth rates tend to be rather volatile and the dataset is a short panel with considerable cross sectional variability, I rely on collapsed cross-sectional regressions. To be specific, the dependent variable is the firms' average growth rate within the sample period and firms' initial values enter the regressions as explanatory variables[30]. Thus there is one observation per firm in the regression, and by so doing, time series variability is sacrificed for more reliable results.

As a baseline, I start with least squares methods with robust standard errors (referred to as least squares robust regression), followed by two alternative robust regression approaches. The first, is the outlier robust regression (Rousseeuw and Leroy, 1987) and the second is the median regression, a special case of quantile regressions (Koenker and Bassett, 1978).

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[30] The use of initial values also mitigates potential endogeneity.

The outlier robust regression offers estimates that are not sensitive to the presence of the observations with extreme values and effectively controls for heteroskedastic errors. It is essentially a three-step procedure. The first step involves estimating the regression by OLS and calculating Cook's distance measure of influence. Cook's distance (*CD*) is a measure of the distance between the coefficient estimates when observation *i* is included and when it is not. It is defined as:

$$CD_i = \frac{\hat{\varepsilon}_{si}^2 (s_{pi} / s_{ri})^2}{k}$$

where $\hat{\varepsilon}_{si}$ refers to standardised residuals, s_{ri} refers to the standard error of the residuals, s_{pi} refers to the standard error of prediction, and k represents the number of independent variables including the intercept term. High values of *CD* imply that the i^{th} observation has significant influence on estimation results and therefore, can be deemed to be an outlier. The second step is to screen data points by identifying observations for which *CD* exceeds unity (they are considered the gross outliers). Thereafter, robust regression involves an iterative weighted least squares method whereby outliers are identified and weights that are inversely proportional to *CD* are assigned.

In contrast to OLS that minimises the sum of squared residuals, median regression minimises the sum of absolute deviations. Whereas OLS provides a regression line that passes through the mean of the dependent variable, median regression fits a line that passes through the median. It is thus less sensitive to outlying observations (e.g. Greene, 2003) as the median is a more robust measure of central tendencies than the mean. The higher discrepancy between OLS and median regression estimates is, the more skewed is the distribution of the error term.

Since a large micro dataset is in use, it is natural to expect large firm heterogeneity. Accordingly, the regressions will also be conducted by ownership structure, firm size and economic region, as the growth of firms within these different groups is likely to react differently to changes in capital structure.

3.4.3 The data

The data draw on the Annual Reports of Industrial Enterprise Statistics compiled by the National Bureau of Statistics (NBS) of China, covering the population of Chinese state-owned manufacturing enterprises and non-state-owned enterprises with annual turnover more than 5 million RMB Yuan (about $620,000). The sample accounts for nearly 88% of total industrial output. The dataset spans the period of 1999-2002, containing detailed information on output, assets, source of finance, exports, sales, value added, employment, wages, R&D expenditure, product innovation and employee training outlay, as well as the ownership structure, industry affiliation, geographic location[31]. The data exhibit a good balance across the manufacturing industries and provinces in China. For ease of analysis, firms are grouped into six geographical regions and classified into state-owned enterprises (*SOEs*), collectively owned enterprises (*COEs*), domestic private firms (*Private*) and foreign invested firms (*FIEs*). The firm classifications in terms of ownership structure, industry and economic region used in this thesis are detailed in Appendix 2 and Appendix Table 1~2.

Table 2 provides descriptive statistics of the relevant variables. The average firm age is approximately 12 years, while SOEs are relatively older (more than 20 years). In terms of productivity level, foreign firms are far more productive than domestics firms, especially SOEs. The average exporting intensity is 15.89%, and not surprisingly FIEs are the most export-oriented ones. Chinese firms do not seem very innovative. On average the innovation output share in total output is only 2.6%. FIEs have the highest rates of innovation, followed by SOEs and private firms.

[31] The data are deflated using industry-specific ex-factory price indices obtained from China Statistical Yearbook (2000-2003).

SPECIAL NOTE

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Table 2: Descriptive Statistics of Some Relevant Variables

Variables	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
	Overall		SOEs		Collectives		Private		Foreign	
Dependent variable										
Employment growth	0.072	0.734	-0.012	0.842	0.097	0.674	0.079	0.676	0.176	0.739
Firm Characteristics										
Age	11.8	13.2	20.4	17.3	12.8	11.0	8.1	10.4	6.1	4.4
Size (log of total employment)	4.469	1.587	4.481	1.922	4.372	1.569	4.503	1.350	4.499	1.635
TFP level	0.925	1.181	0.282	1.403	1.158	1.005	1.078	0.984	1.229	1.172
Growth of capital intensity (log(net fixed assets/total employment))	-1.064	1.765	-0.852	1.941	-1.235	1.682	-1.267	1.568	-0.465	1.997
Exporting intensity (exports/total employment)	0.158	0.733	0.161	0.741	0.120	0.424	0.117	0.419	0.397	0.851
Innovation intensity (New products sales/total sales)	0.026	0.131	0.028	0.125	0.014	0.095	0.027	0.135	0.039	0.170
Labour quality (total wage and salary/total employment, normalized by average level by industry, province and ownership)	1	2.339	1	2.992	1	2.226	1	2.051	1	1.937
Financing share (in total external finance)										
State budgets	0.139	0.301	0.463	0.411	0.014	0.097	0.046	0.171	0.068	0.182
Domestic bank loans	0.173	0.277	0.251	0.318	0.189	0.286	0.146	0.257	0.087	0.191
Self-raised finance	0.573	0.429	0.102	0.267	0.785	0.306	0.800	0.316	0.312	0.323
Foreign investments	0.115	0.283	0.184	0.375	0.012	0.088	0.008	0.075	0.533	0.330
Financing choice Dummy										
State budgets	0.132	0.338	0.429	0.495	0.011	0.106	0.042	0.202	0.063	0.243
Domestic bank loans	0.158	0.365	0.231	0.421	0.171	0.376	0.133	0.339	0.081	0.273
Self-raised finance	0.560	0.496	0.086	0.281	0.727	0.445	0.784	0.411	0.329	0.470
Foreign investments	0.104	0.305	0.172	0.377	0.009	0.092	0.006	0.079	0.475	0.499
Number of observations	563,214		134,005		119,341		230,973		78,895	

Note: The statistics are calculated by averaging the observations from 1999-2002.

Table 3 depicts firms' financing pattern on average and by ownership structure. During 1999-2002, finance from state budgets, domestic bank loans, self-raised finance and foreign investments accounted for 19.2%, 31%, 25%, and 24.8% of firms' total finance respectively. Bank loans supply the largest fraction of firms' total finance for all types of firms, except for FIEs, more than half of whose investment is financed by foreign sources (around 52.7%). It is also interesting to note that self-raised finance is mostly composed of finance from collectives (6%), corporations (14.4%) and individuals (4.6%)[32], and it is the most important source of financing for COEs (64.7%) and private firms (41.5%)[33].

Table 3: Financing Pattern by Firm Ownership during 1999-2002

Type of Firms	No. of observations	State Budgets	Bank loans	Self-raised finance				Foreign Investments
				Collectives	Corporation	Individuals	*Total*	
SOEs	134,005	34.3	***39.9***	0.5	11.1	1.01	***12.61***	***13.3***
Collective firms	119,341	1.5	***30.9***	45.4	12.3	7	***64.7***	***2.9***
Private firms	230,973	20.9	***35.4***	4.3	21.9	15.3	***41.5***	***2.2***
FIEs	78,895	8.1	***20.3***	3.6	13.8	1.5	***18.9***	***52.7***
Total	***563,214***	***19.2***	***31***	***6***	***14.4***	***4.6***	***25***	***24.8***

Note: The figures are percentages, except for the number of observations.
Source: Authors calculations based on the database used in this paper.

3.5 CAPITAL STRUCTURE AND FIRM GROWTH

3.5.1 Baseline results

Table 4 reports the estimates using six different econometric methods: least squares robust regression, outlier robust regression, median regression, Heckit, MCF and MCF with a selection mechanism. The outlier robust regression and median regression estimates are very similar, and both have bigger discrepancies from least squares robust estimates. This indicates the heterogeneous nature of firm-level data and thus the application of robust estimators is necessary. There is a significant unobserved selection effect. The negative correlation between ε_i and v_i indicates that an analysis without

[32] This breakdown is not available at the macro-level in the China Statistics Yearbook.
[33] Allen et al (2005) also report that self-raised finance captures somewhere between 45% and 65% of the total finance for state- or quasi- state-owned companies. According to this research, the figures are considered to be exaggerated since self-raised finance is found to consist of 12.61% of SOEs' total finance. The difference might be due to their definition of quasi- state-owned companies.

accounting for survivorship would produce a lower-bound estimate[34]. The statistical significance of the correction functions produced by the MCF estimator also vindicates the endogeneity bias correction approach.

An inverted U-shaped relationship is found between firm size and growth. On average small and large firms grow faster than medium-sized firms, *ceteris paribus*, consistent with other empirical evidence (e.g. Evans, 1987a; Konings and Xavier, 2002). Gibrat's Law (that is the hypothesis that firm growth is independent of firm size, Gibrat, 1931; Sutton, 1997) does not hold for Chinese manufacturing firms, at least during the examined period. There is a positive correlation between firm TFP level, capital intensity and their employment growth, suggesting that *ceteris paribus*, initially more productive or more capital-intensive firms have greater potential to grow. Exporting intensity is found to have strong growth-enhancing effects, and labour quality also has positive effects on firm growth according to the robust regression estimates. This effect, however, is not significant in the MCF estimates. Finally, there is no evidence of a significant relationship between innovation activity, firm age and employment growth.

Focusing on the finance variables, a discernible pecking order regarding the relative efficiency with which different financing channels drive firm growth has emerged. This order runs in a decreasing order of importance, from foreign finance, to self-raised finance, to domestic bank loans and finally to state budgets (which is the omitted group in the regressions). For example, taking the estimates of the outlier robust regression, foreign investment boosts firm growth around twice as much as self-raised finance, and almost thrice as much as domestic bank loans, and considerably more than state budgets.

The selection and endogeneity corrected estimates of the coefficients on the finance variables are slightly lower (higher) as selection (endogeneity) is controlled for. This indicates that the effects of finance variables on firm growth would be overstated

[34] This downward bias is an overall direction of bias. For the effect on each independent variable, the bias depends on the correlation between the variable and the selection term.

(understated) if one neglects the issue of selectivity (endogeneity). Interestingly, the importance of foreign investment and bank loans relative to self-raised finance seem to decline sharply when both selection and endogeneity are considered. This would appear to suggest that the access to foreign investment and bank loans is more systematically correlated with firm performance. Nonetheless, even after controlling for endogeneity and selection, the pecking order in the capital structure remains intact. This provides evidence in support of Majumdar's (1996a) property rights theory of state-owned financial institutions.

Table 4: Capital Structure and Firm Growth

Dep. var: Employment	Estimation Methods					
Variables	(1)Robust-OLS	(2)Outlier robust	(3)Median	(4)Heckit	(5)MCF	(6)MCF, select
Foreign finance	0.147**	0.0831***	0.0828***	0.125***	0.0845***	0.0565***
	(0.0086)	(0.0031)	(0.0031)	(0.0066)	(0.012)	(0.010)
Self-raised finance	0.0543*	0.0441***	0.0394***	0.0568**	0.0365***	0.0375***
	(0.0071)	(0.0027)	(0.0026)	(0.0059)	(0.0078)	(0.0071)
Bank loans	0.0444*	0.0349***	0.0343***	0.0363**	0.0294***	0.0160**
	(0.0077)	(0.0029)	(0.0029)	(0.0065)	(0.0088)	(0.0062)
Age	0.00013	-	0.000175*	0.000527	0.00187***	0.00172***
	(0.00026	(0.000079)	(0.000078)	(0.00019)	(0.00057)	(0.00056)
Age-squared	-	-0.0000541	-	0.000393	-0.00171	0.00309*
	(0.00044	(0.00011)	(0.00011)	(0.00027)	(0.0016)	(0.0016)
Size	-	-0.474***	-0.501***	-0.533***	-0.548***	-0.527***
	(0.0064)	(0.0013)	(0.0013)	(0.0030)	(0.0091)	(0.0062)
Size-squared	0.0472*	0.0399***	0.0427***	0.0414**	0.0938***	0.0409***
	(0.00071	(0.00015)	(0.00015)	(0.00034)	(0.0022)	(0.00064)
TFP	0.0619*	0.0346***	0.0347***	0.0302**	0.0662***	0.0390***
	(0.0018)	(0.00056)	(0.00056)	(0.0013)	(0.0043)	(0.0042)
Growth of Capital	0.0480*	0.0339***	0.0312***	0.0431**	0.0669***	0.0461***
	(0.0015)	(0.00042)	(0.00042)	(0.00091)	(0.0028)	(0.0030)
Exporting Intensity	0.0303*	0.0583***	0.0444***	0.0301**	0.0702**	0.0845***
	(0.0085)	(0.0010)	(0.0010)	(0.0022)	(0.030)	(0.030)
Innovation Intensity	0.00950	-0.0108**	-0.0129***	0.0254**	-0.0468	0.0315
	(0.0098)	(0.0042)	(0.0042)	(0.0089)	(0.035)	(0.034)
Labour quality	0.0117*	0.0252***	0.0191***	0.0130**	0.00749	0.00528
	(0.0020)	(0.00025)	(0.00024)	(0.00056)	(0.0070)	(0.0040)
Collective Dummy	0.0528*	0.0215***	0.0266***	0.0634**	0.0539***	0.0580***
	(0.0056)	(0.0022)	(0.0022)	(0.0052)	(0.0060)	(0.0070)
Private Dummy	0.0928*	0.0365***	0.0402***	0.0323**	0.0952***	0.0294***
	(0.0055)	(0.0021)	(0.0021)	(0.0048)	(0.0061)	(0.0065)
Foreign Dummy	0.0243*	0.00177	0.00470**	-	0.00534	-0.0293***
	(0.0053)	(0.0022)	(0.0022)	(0.0050)	(0.0066)	(0.0070)
Central Area	0.0240*	0.0177***	0.0169***	0.0311**	0.0306***	0.0428***
	(0.0035)	(0.0015)	(0.0015)	(0.0033)	(0.0043)	(0.0041)
West Area	-	0.0114***	0.0103***	0.0228**	-0.0160**	0.0399***
	(0.0053)	(0.0019)	(0.0019)	(0.0041)	(0.0070)	(0.0045)
Selection mechanism (atanh(rho))				-.6713***		-0.674***
				(0.0089)		(0.037)
IV for					0.30***	0.27***
IV srf					0.8***(0.085)	0.92***(0.0
IV bl					0.3*(0.164)	0.33**(0.14)
Constant	1.441**	1.202***	1.270***	1.566***	1.202***	1.419***
	(0.015)	(0.0037)	(0.0036)	(0.0092)	(0.022)	(0.019)
Observations	166977	166977	166977	192032	166977	192032

Note 1: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Note 2: The reported selection mechanism (atanh(***rho***)) is the inverse hyperbolic tangent of the correlation coefficient ***rho*** between residual terms of main equation and selection equation, i.e. atanh(rho)=0.5[ln(1+rho)/(1-rho)]. The test of atanh(rho) is equivalent to the test of rho=1. Insignificant atanh(rho) indicates that selectivity bias is negligible.

Note 3: MCF refers to modified control function approach due to Wooldridge (2005). The method involves a correction function (*CF*) for endogenous variables (finance variables in this case), and the interaction terms of endogenous variables and exogenous covariates Financejj* (Xi-u(Xi)). A statistically significant interaction term (abbreviated to *iv_for*, *iv_sfr* or *iv_bl*) is the evidence in favour of the hypothesis of endogeneity.

Note 4: All estimations include the full sets of industry and regional dummies, both of which are jointly significant in all specifications.

3.5.2 Firm ownership, finance and growth

Table 5 shows estimates of the regressions by ownership structure. Given the results based on robust estimators are fairly similar, in what follows I only report and discuss the estimates of the outlier robust regression and MCF with selection mechanism.

Contrasting patterns in the relationship between finance and growth emerge across different ownership structures. The SOEs exhibit the pecking order found in the overall sample. According to the robust regression results, the marginal effect of foreign finance is 10% and far more economically significant than bank loans and self-raised finance, for which the marginal effects are both just above 1%. Controlling for endogeneity and selection does not affect the importance of foreign finance for SOEs' growth, but it weakens the significance of bank loan. It is further evident that finance issued by state-owned financial institutions tends to be less efficient (Majumdar, 1996a). Furthermore, only foreign investment is found to be endogenous, suggesting that access to bank loans and self-raised finance are not significantly affected by SOE's growth experience.

For COEs, the only effect found to be significantly positive in the robust regression is bank loans. But even this disappears as selection and endogeneity biases are controlled for, suggesting that the source of finance in firm's capital structure does not matter for COEs' growth. For private firms, self-raised finance appears to be the most growth-enhancing financing source, corroborating Allen et al.'s (2005) conjecture that informal financial sources must have driven private firms growth experience. Interestingly, self-raised finance appears to be the most effective financing source for FIEs employment growth, indicating the importance of local finance for the job generations by multinational enterprises.

SPECIAL NOTE

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Table 5: Ownership, Capital Structure and Firm Growth

Dep. var: Employment Growth	Estimation Method/Firms by ownership structure							
	Outlier robust regression				MCF, select			
Variables	SOEs	Collectives	Private	FIEs	SOEs	Collectives	Private	FIEs
Foreign finance	0.103***	0.0180	0.00673	0.0665***	0.105***	-0.0287	-0.000917	0.0570***
	(0.0044)	(0.016)	(0.014)	(0.0086)	(0.017)	(0.049)	(0.037)	(0.016)
Self-raised finance	0.0109**	0.0177	0.0439***	0.0625***	0.0350***	-0.0104	0.0307*	0.0643***
	(0.0050)	(0.011)	(0.0054)	(0.0081)	(0.013)	(0.035)	(0.017)	(0.015)
Bank loans	0.0143***	0.0214*	0.0335***	0.0600***	-0.0102	-0.0226	0.0331*	0.0485**
	(0.0043)	(0.011)	(0.0062)	(0.011)	(0.0092)	(0.036)	(0.020)	(0.020)
Age	0.00182***	0.000218	-0.0010***	-0.0076***	0.00221***	0.00227***	-0.00283**	-0.00725*
	(0.00012)	(0.00025)	(0.00018)	(0.00057)	(0.00042)	(0.00076)	(0.0013)	(0.0039)
Age-squared	-0.0042***	-0.00173	0.000630	0.0279***	-0.00130	-0.00531*	0.00647**	0.0514***
	(0.00026)	(0.0011)	(0.00066)	(0.0029)	(0.00091)	(0.0031)	(0.0032)	(0.014)
Size	-0.412***	-0.531***	-0.448***	-0.537***	-0.444***	-0.508***	-0.674***	-0.561***
	(0.0025)	(0.0025)	(0.0025)	(0.0032)	(0.0071)	(0.0080)	(0.013)	(0.013)
Size-squared	0.0660***	0.0941***	0.0745***	0.0942***	0.0321***	0.0402***	0.0551***	0.0462***
	(0.00056)	(0.00061)	(0.00057)	(0.00077)	(0.00076)	(0.00099)	(0.0013)	(0.0014)
TFP	0.0466***	0.0262***	0.0297***	0.0281***	0.0334***	0.0331***	0.0200**	0.0239***
	(0.0010)	(0.0012)	(0.0010)	(0.0014)	(0.0053)	(0.0039)	(0.0097)	(0.0091)
Growth of Capital	0.0582***	0.0225***	0.0274***	0.0229***	0.0727***	0.0371***	0.0287***	0.0245***
	(0.00084)	(0.00084)	(0.00073)	(0.0010)	(0.0026)	(0.0027)	(0.0065)	(0.0059)
Exporting Intensity	0.0639***	0.0407***	0.0632***	0.0389***	0.0102	0.0793***	0.164***	0.00276
	(0.0019)	(0.0034)	(0.0030)	(0.0025)	(0.012)	(0.015)	(0.019)	(0.032)
Innovation Intensity	-0.0246***	-0.0156	0.00866	-0.0131	-0.00943	0.0260	0.0452	-0.00614
	(0.0094)	(0.011)	(0.0066)	(0.0084)	(0.021)	(0.054)	(0.090)	(0.036)
Labour quality	0.0104***	0.0431***	0.0385***	0.0193***	0.0106***	0.0264***	0.0180	0.00811
	(0.00040)	(0.00065)	(0.00041)	(0.00076)	(0.0019)	(0.0039)	(0.013)	(0.011)
Central Area	0.0379***	0.0165***	0.00855***	-0.00423	0.0421***	0.0285***	0.0295***	0.00309
	(0.0030)	(0.0025)	(0.0025)	(0.0054)	(0.0076)	(0.0065)	(0.0051)	(0.015)
West Area	0.0151***	0.00223	0.0177***	-0.00498	0.0397***	-0.0117*	0.0126	0.0336***
	(0.0035)	(0.0037)	(0.0031)	(0.0074)	(0.0079)	(0.0067)	(0.0079)	(0.012)
Selection mechanism (atanh(***rho***))					-0.8***	-0.87***	0.725***	-0.398**
					(0.085)	(0.05)	(0.06)	(0.19)
IV_for					0.17***(0.02)		-19.9**(8.5)	-6.3***(1.53)
IV_srf							12.92***(2.4)	
IV_bl						-0.76***(0.19)	0.47**(0.2)	-5.4***(0.99)
Constant	1.088***	1.319***	1.163***	1.388***	1.426***	1.641***	0.892***	2.141***
	(0.0063)	(0.013)	(0.0081)	(0.012)	(0.031)	(0.040)	(0.16)	(0.15)
Observations	41792	38668	64070	22445	50781	46013	64071	24432

Note 1: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Note 2: The reported selection mechanism (atanh(***rho***)) is the inverse hyperbolic tangent of the correlation coefficient ***rho*** between residual terms of main equation and selection equation, i.e. atanh(rho)=0.5[ln(1+rho)/(1-rho)]. The test of atanh(rho) is equivalent to the test of rho=1. Insignificant atanh(rho) indicates that selectivity bias is negligible.

Note 3: MCF refers to modified control function approach due to Wooldridge (2005). The method involves correction function (*CF*) for endogenous variables (finance variables in this case), and the interaction terms of endogenous variables and exogenous covariates Financejj* (Xi-u(Xi)). A statistically significant interaction term (abbreviated to *iv_for*, *iv_sfr* or *iv_bl*) is the evidence in favour of the hypothesis of endogeneity.

Note 4: All estimations include the full sets of industry and regional dummies, both of which are jointly significant in all specifications.

3.5.3 Firm size, capital structure and growth

In this section, I allow firm size to mediate the relationship between capital structure and firm growth. This is motivated by the recent research interests in discovering the distribution effect of financial development on firm size (Beck, Demirguc-Kunt and Laeven and Levine, 2006).

Some theories suggest that because small firms tend to suffers the most as a result of not being able to access finance due to underlying weaknesses of institutional environment, they benefit disproportionately from financial development. This relaxes their financing constraints. Large firms tend to internalise many of the capital allocation functions carried out by financial markets and financial intermediaries. They tend to benefit less from the development of financial markets and institutions compared to their smaller counterparts (Beck, Demirguc-Kunt and Maksimovic, 2005; Beck, Demirguc-Kunt, Laeven and Maksimovic, 2006; Beck, Demirguc-Kunt and Laeven and Levine, 2006).

In contrast, Greenwood and Jovanovic (1990) find small firms cannot afford financial service and financial development simply boosts aggregate growth by helping big firms. Some research reaching similar results argues that bigger firms, compared to smaller firms, are more likely to depend on long-term financing and larger loans for their development (Beck, Demirguc-Kunt and Laeven and Levine, 2006). Although quite a number of empirical studies have provided cross-country and industry evidence, the role of firm size in the relationship between finance and growth appears an ultimate empirical issue which has to be determined on a case-by-case basis (Beck, Demirguc-Kunt, and Maksimovic, 2005).

Following Beck, Demirguc-Kunt, and Maksimovic (2005), firm size groups are defined as follows: *Small* firms are those with fewer than 20 employees (11.3% of total sample); firms employing 21~100 employees are called *medium-sized* firms (40%); those that employ 101~500 employees are deemed to be *large* firms (38.6%), and finally those

with more than 500 employees are labelled *super large* firms (10.12%).

I start by estimating the model on the whole sample, replacing continuous size variables with size dummies. The purpose of this is to show more clearly and discretely the different effects of different size groups. Table 6 shows that doing so does not alter estimation results reported in Table 4 noticeably. The coefficients of the size dummies suggest that, *ceteris paribus*, small firms grow the fastest, followed by medium firms, and then large firms.

For small firms, self-raised finance and bank loans have significantly positive coefficients in the robust regression (compared to state finance), but selection and endogeneity corrections wipe out the effects. This seems to suggest that controlling for selectivity and endogeneity, self-raised finance and bank loans do not have distinctive growth-enhancing effects from state finance. In fact, the coefficient of bank loans turns negative. This result suggests that capital structure does not seem to determine the rate of growth of small firms, in comparison to other factors such as productivity, capital stock, export and innovation. This may also be at odds with the argument that small firms cannot afford financial services, especially in poor countries (Greenwood and Jovanovic, 1990), so that access to bank loans harms small firm's growth potential relative to large firms.

For medium-sized firms, the finance variables are statistically significant and quantitatively different. The results generally reflect the pecking order that was discussed earlier, foreign investment, self-raised finance and bank loans show declining level of importance to firm growth.

For large firms, foreign investment and self-raised finance show significant positive effects on firm growth, while bank loans' impact vanishes. For very big firms, however, only foreign investment has a growth-boosting effect, and domestic sources do not appear to make much difference as far as employment growth is concerned.

Given the results discussed above, one possible explanation is that getting finance is

more critical for survival of small firms than bigger firms, so the source finance does not appear to matter much. Medium and larger firms on the other hand, being better established and developed, although not necessarily less financially constrained, benefit most from foreign investment as it offers access to international markets, technology advances and managerial expertise.

This set of results, based on firm-level analysis, cannot offer direct evidence on whether "small-firm industries" benefit more from financial reforms, reflecting what has been reported in industry-level studies such as Beck, Demirguc-Kunt, and Maksimovic (2005). To do so, we need industry level studies. But the results show that the link between capital structure and firm growth varies by firm size, which can give some intuition of the possible channel (for example financing source) through which firm size plays an noticeable role in industrial growth.

Table 6: Firm Size, Capital Structure and Firm Growth

Dep.var: Emp. Growth	I. Outlier Robust Regression					II. MCF,select				
Size Group	(1)Overall	(2)Small	(3)Medium	(4) Large	(5) Super large	(6)Overall	(7)Small	(8) Medium	(9) Large	(10) Super large
Small	1.539***					0.984***				
	(0.0023)					(0.013)				
Medium	0.0912***					0.181***				
	(0.0017)					(0.0078)				
Large	0.0428***					0.0903***				
	(0.0016)					(0.0064)				
Foreign finance	0.0538***	-0.00161	0.0568***	0.0489***	0.0524***	0.0517***	0.0416	0.0719***	0.0598***	0.0864***
	(0.0027)	(0.017)	(0.0046)	(0.0034)	(0.0055)	(0.012)	(0.039)	(0.018)	(0.0092)	(0.021)
Self-raised finance	0.0225***	0.0317**	0.0289***	0.0166***	0.00847*	0.0379***	0.0412	0.0400***	0.0254***	-0.00672
	(0.0023)	(0.015)	(0.0041)	(0.0031)	(0.0044)	(0.0061)	(0.035)	(0.013)	(0.0086)	(0.020)
Bank loans	0.0105***	0.0466***	0.0245***	0.0134***	0.00295	-0.0240***	-0.122***	0.0295**	0.0137	-0.00544
	(0.0025)	(0.017)	(0.0045)	(0.0032)	(0.0045)	(0.0071)	(0.039)	(0.013)	(0.0091)	(0.018)
Age	-0.00153***	-0.00164**	-0.00271***	-0.00167***	-0.000764***	0.00188***	-0.0114***	0.00155**	0.00212***	-0.000624
	(0.000068)	(0.00072)	(0.00018)	(0.00012)	(0.000091)	(0.00046)	(0.0027)	(0.00066)	(0.00075)	(0.0010)
Age-squared	0.00125***	0.00607***	0.00401***	0.00142***	0.000208**	-0.00117	0.0427***	-0.000185	-0.00189	0.00426*
	(0.000093)	(0.0013)	(0.00035)	(0.00022)	(0.000081)	(0.0011)	(0.012)	(0.0019)	(0.0023)	(0.0025)
Size		-0.555***	-0.0677**	-0.117***	0.000367		-1.147***	-0.239***	-0.199*	-0.0137
		(0.017)	(0.033)	(0.037)	(0.019)		(0.033)	(0.068)	(0.11)	(0.19)
Size-squared		0.0630***	0.00347	0.00821**	-0.00106		0.199***	0.0174**	0.0127	-0.00131
		(0.0056)	(0.0042)	(0.0035)	(0.0013)		(0.0086)	(0.0085)	(0.010)	(0.013)
TFP	0.0266***	0.106***	0.0165***	0.0182***	0.0222***	0.0939***	0.0331***	0.0482***	0.0212***	0.0124
	(0.00047)	(0.0031)	(0.00086)	(0.00065)	(0.00095)	(0.0044)	(0.0078)	(0.0051)	(0.0039)	(0.0085)
Growth of Capital	0.0199***	0.0815***	0.0128***	0.00860***	0.00959***	0.119***	0.0248***	0.0318***	0.0208***	0.0318***
	(0.00033)	(0.0020)	(0.00065)	(0.00051)	(0.00089)	(0.0020)	(0.0062)	(0.0029)	(0.0022)	(0.0047)
Exporting Intensity	0.0328***	0.0868***	0.0328***	0.0217***	0.0227***	0.0458	0.0745***	0.0198	0.0312	0.0377*
	(0.00088)	(0.0085)	(0.0014)	(0.0010)	(0.0023)	(0.033)	(0.022)	(0.026)	(0.021)	(0.022)
Innovation Intensity	-0.000518	0.122***	0.0206***	0.00288	-0.0130**	-0.0298*	0.214**	0.00317	-0.0443	-0.0131
	(0.0037)	(0.031)	(0.0065)	(0.0047)	(0.0059)	(0.018)	(0.084)	(0.040)	(0.034)	(0.029)
Labour quality	0.0271***	0.00706***	0.0436***	0.0328***	0.0274***	0.000385	0.0115***	0.0633***	0.0483***	0.0580***
	(0.00021)	(0.00057)	(0.00061)	(0.00089)	(0.0016)	(0.0018)	(0.0032)	(0.0053)	(0.010)	(0.019)
Collective Dummy	-0.000322	-0.00133	0.0169***	0.00183	0.00542	0.0271***	0.115***	0.0256***	0.0695***	0.0834***
	(0.0019)	(0.014)	(0.0035)	(0.0025)	(0.0037)	(0.0064)	(0.031)	(0.0093)	(0.0064)	(0.014)
Private Dummy	0.0183***	0.0727***	0.0336***	0.0148***	0.00964***	0.0602***	0.279***	0.0624***	0.0250***	0.0183
	(0.0018)	(0.013)	(0.0034)	(0.0023)	(0.0029)	(0.0099)	(0.026)	(0.0093)	(0.0070)	(0.012)
Foreign Dummy	-0.00891***	-0.0322**	0.00360	0.000611	-0.00159	-0.0390***	0.0629**	0.00849	0.00207	-0.0218
	(0.0019)	(0.013)	(0.0034)	(0.0024)	(0.0039)	(0.0089)	(0.027)	(0.0088)	(0.0077)	(0.015)
Selection mechanism (atanh(*rho*))									-1.2***	-1.305***
									(0.05)	(0.17)
IV for						0.38***(0.034)		0.21***(0.03)	0.135***(0.04)	
IV srf						0.88***(0.079)		1.18***(0.15)	0.50***(0.11)	0.49**(0.23)
IV bl						1.73***(0.59)		-0.517**(0.21)	-1.127**(0.45)	
Constant	-0.125***	1.022***	0.152**	0.315***	-0.0537	-0.399***	1.648***	0.364***	0.623**	0.101
	(0.0028)	(0.017)	(0.063)	(0.099)	(0.071)	(0.025)	(0.053)	(0.13)	(0.29)	(0.67)
Observations	166977	16494	61361	68986	20135	170542	16494	61361	69889	20400

Note 1: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Note 2: *Small*, *Medium*, *Large* and *Super Large* are dummy indicator of firm size. Each takes the value 1 if a firm is small (or medium or large or super large) and 0 otherwise. Small firms employ 1–20 employees, medium-size firms employ 21~100 employees, and large firms employ 101~ 500 employees, and super large firms employ more than 500 employees.

Note 3: The reported selection mechanism (atanh(***rho***)) is the inverse hyperbolic tangent of the correlation coefficient ***rho*** between residual terms of main equation and selection equation, i.e. atanh(rho)=0.5[ln(1+rho)/(1-rho)]. The test of atanh(rho) is equivalent to the test of rho=1. Insignificant atanh(rho) indicates that selectivity bias is negligible.

Note 4: MCF refers to modified control function approach due to Wooldridge (2005). The method involves correction function (*CF*) for endogenous variables (finance variables in this case), and the interaction terms of endogenous variables and exogenous covariates Financejj* (Xi-u(Xi)). A statistically significant interaction term (abbreviated to *iv_for*, *iv_sfr* or *iv_bl*) is the evidence in favour of the hypothesis of endogeneity.

Note 4: All estimations include the full sets of industry and regional dummies, both of which are jointly significant in all specifications.

3.5.4 Capital structure and firm growth: regional differences

The increasing regional disparity in China and its possible reasons have been extensively studied in recent years, both at a microeconomic level (focusing on household income distribution), and a macroeconomic level, focusing on differences in provincial GDP per capita and consumption level, are summarized in Démurger et al (2002). The explanation is preferential policies in economic opening, international trade, infrastructure investment of communications, for example, roads, railway, waterways and telephones (see for example Fleisher and Chen, 1997; Mody and Wang, 1997; and Démurger, 2001).

This section splits firms into six groups. This is common among studies of Chinese regional difference. The regions identified are: metropolis, northeast, coast, central, northwest and southwest. Much of the literature that documents regional differences has not been detailed and is limited to the difference between coastal areas and inland areas. For example, as Démurger (2002) records, coastal regions enjoy "preferential policies" that marketize and internationalize these regional economies. In fact these policies are rather "deregulation policies", under which firms are allowed to import intermediate inputs duty-free to produce exports, collaborate with foreign companies in investment, manufacturing and distribution and escape the confiscatory taxation that is needed in a centrally planned economy to finance its vast, complicated system of local subsidies. In return for these economic liberties, these firms do not receive state subsidies when they experience losses. On the other hand, the special policies the northeast provinces received have been quite different – a steady transfer to prop up failing enterprises in order to maintain the living standard in the region.

Table 7 presents the results from estimation across six economic regions. The robust regression results suggest that capital structure matters to firm growth in most regions. The pecking order, which was established based on the whole sample, also holds in the metropolis and coastal areas. By contrast, in central and northwest areas, only self-raised finance and bank loans boost firm growth, while in the northeast area foreign investment

and self-raised finance are the significant sources of growth. In the southwest, all sources of finance (apart from state budgets) have quantitatively equivalent effects on firm growth.

Controlling for selectivity and endogeneity does not change the results significantly for costal areas where the pecking order remains, and foreign investment is evidently the most efficient financing sources, followed by self-raised finance and bank loans. In the northwest, bank loans seem to be the most important source of finance. The pecking order is clear in the southwest after controlling for selectivity and endogeneity, and the coefficients are the largest among all the regions. Correcting for endogeneity seems to have opposite effects in Metropolis and northeast, where the pecking order is now eliminated and the result suggests that bank loans decrease firm growth compared to other financing sources. This suggests that the causal relationship between firm growth and capital structure is stronger in the metropolis and the northeast, where big and old SOEs tend to concentrate, and disproportionately large amount of bank loans tend to flow to poorly performing SOEs.

SPECIAL NOTE

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Table 7: Capital Structure and Firm Growth: Regional Differences

Dep. var: Employment Growth	Robust Regression						MCF, select					
Variables	Metropolis	Northeast	Coastal	Central	Northwest	Southwest	Metropolis	Northeast	Coastal	Central	Northwest	Southwest
Foreign finance	0.0781***	0.0572**	0.0794***	0.0115	0.0165	0.0355**	0.0360	-0.0893	0.0690***	0.156***	0.00490	0.151***
	(0.0085)	(0.022)	(0.0043)	(0.0094)	(0.041)	(0.014)	(0.032)	(0.059)	(0.015)	(0.039)	(0.16)	(0.046)
Self-raised finance	0.0325***	0.0227*	0.0510***	0.0170***	0.0447***	0.0329***	-0.000297	0.0113	0.0463***	0.0409**	0.103***	0.104***
	(0.0068)	(0.012)	(0.0043)	(0.0041)	(0.013)	(0.0061)	(0.019)	(0.025)	(0.012)	(0.020)	(0.040)	(0.017)
Bank loans	0.0222**	0.0125	0.0390***	0.00855**	0.0404***	0.0338***	-0.0382*	-0.0357*	0.0394***	0.0153	0.117**	0.0957***
	(0.0096)	(0.013)	(0.0048)	(0.0040)	(0.013)	(0.0060)	(0.022)	(0.021)	(0.011)	(0.017)	(0.046)	(0.019)
Age	-0.0010***	0.0022***	-0.0006***	-0.00092***	0.00137**	-0.0016***	0.00512***	0.0032***	0.00260***	0.00141	-0.00198	0.00349**
	(0.00032)	(0.00031)	(0.00011)	(0.00016)	(0.00063)	(0.00032)	(0.00093)	(0.0010)	(0.00066)	(0.0014)	(0.0029)	(0.0014)
Age-squared	0.000695	-0.0024***	0.000168	0.000729**	-0.000376	0.00175***	-0.00999***	-0.00491	0.000257	0.00533	0.00137	-0.00275
	(0.00046)	(0.00031)	(0.00014)	(0.00029)	(0.0012)	(0.00062)	(0.0020)	(0.0030)	(0.0018)	(0.0047)	(0.012)	(0.0040)
Size	-0.451***	-0.474***	-0.479***	-0.0570***	-0.448***	-0.0401***	-0.643***	-0.563***	-0.480***	-0.915***	-0.518***	-0.673***
	(0.0043)	(0.0054)	(0.0020)	(0.0031)	(0.0058)	(0.0040)	(0.021)	(0.015)	(0.0062)	(0.039)	(0.018)	(0.040)
Size-squared	0.0387***	0.0368***	0.0407***	0.00302***	0.0360***	0.00147***	0.0509***	0.0424***	0.0373***	0.0737***	0.0386***	0.0545***
	(0.00052)	(0.00065)	(0.00022)	(0.00031)	(0.00071)	(0.00042)	(0.0024)	(0.0017)	(0.00074)	(0.0036)	(0.0025)	(0.0038)
TFP	0.0349***	0.0543***	0.0338***	0.0130***	0.0606***	0.0142***	0.0143**	0.0660***	0.0431***	0.0127**	0.109***	0.00798
	(0.0016)	(0.0026)	(0.00083)	(0.00089)	(0.0029)	(0.0013)	(0.0062)	(0.0062)	(0.0052)	(0.0063)	(0.013)	(0.010)
Growth of Capital	0.0380***	0.0577***	0.0282***	0.00727***	0.0726***	0.00849***	0.0521***	0.0667***	0.0431***	0.0263***	0.0573***	0.00894
	(0.0011)	(0.0020)	(0.00060)	(0.00078)	(0.0022)	(0.0011)	(0.0051)	(0.0057)	(0.0026)	(0.0095)	(0.0068)	(0.0088)
Exporting Intensity	0.0755***	0.0309***	0.0533***	0.00171	-0.00893	0.0181**	0.00605	0.0602**	0.0399	0.0532	0.0611	-0.0000646
	(0.0022)	(0.0080)	(0.0016)	(0.0021)	(0.017)	(0.0077)	(0.025)	(0.025)	(0.034)	(0.035)	(0.063)	(0.024)
Innovation Intensity	-0.0168	0.0360*	0.000911	0.00695	-0.00131	0.00382	-0.0132	-0.00498	-0.0186	0.0780	0.114	-0.0785
	(0.011)	(0.022)	(0.0058)	(0.0075)	(0.029)	(0.011)	(0.038)	(0.045)	(0.022)	(0.053)	(0.094)	(0.053)
Labour quality	0.0342***	0.00734***	0.0299***	0.0388***	0.0170***	0.0379***	0.0233***	0.0109***	0.0197***	0.0119	0.00882	0.0528***
	(0.00071)	(0.00054)	(0.00041)	(0.00056)	(0.0019)	(0.0013)	(0.0043)	(0.0042)	(0.0056)	(0.012)	(0.019)	(0.012)
Collective Dummy	0.115***	0.0399***	-0.00848**	0.0161***	0.00329	0.00713	0.0938***	0.118***	0.0258**	0.0412***	0.141***	0.0669***
	(0.0063)	(0.012)	(0.0034)	(0.0034)	(0.012)	(0.0056)	(0.018)	(0.031)	(0.011)	(0.014)	(0.040)	(0.025)
Private Dummy	0.114***	0.0466***	0.0120***	0.0186***	0.0291***	0.0213***	0.00176	0.152***	0.00115	0.00512	0.175***	0.0699***
	(0.0062)	(0.011)	(0.0032)	(0.0032)	(0.011)	(0.0049)	(0.017)	(0.026)	(0.0090)	(0.014)	(0.041)	(0.019)
Foreign Dummy	0.0426***	-0.0430***	-0.00746***	0.0178***	-0.00307	0.00900	-0.0527*	0.0638*	-0.0116*	-0.0346	0.0538	0.0504**
	(0.0061)	(0.015)	(0.0028)	(0.0058)	(0.023)	(0.0084)	(0.027)	(0.039)	(0.0068)	(0.027)	(0.088)	(0.025)
Selection mechanism (atanh(***rho***))							-1.1***		-0.5***	-1.04***		-0.79***
							(0.06)		(0.1)	(0.1)		(0.2)
IV_for							0.34***(0.12)		0.28***(0.04)			
IV_srf									1.58***(0.13)	1.4***(0.25)	-2.8***(0.46)	0.956***(0.29)
IV_bl										0.98**(0.46)		
Constant	1.105***	1.327***	1.216***	0.134***	1.159***	0.0796***	1.987***	1.521***	1.186***	2.521***	1.413***	1.733***
	(0.011)	(0.014)	(0.0056)	(0.0080)	(0.016)	(0.010)	(0.047)	(0.033)	(0.025)	(0.11)	(0.064)	(0.100)
Observations	20024	10100	88030	30305	8060	10457	23245	10100	99855	34172	8060	12852

Note 1: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Note 2: The reported selection mechanism (atanh(***rho***)) is the inverse hyperbolic tangent of the correlation coefficient ***rho*** between residual terms of main equation and selection equation, i.e. atanh(rho)=0.5[ln(1+rho)/(1-rho)]. The test of atanh(rho) is equivalent to the test of rho=1. Insignificant atanh(rho) indicates that selectivity bias is negligible.

Note 3: MCF refers to modified control function approach due to Wooldridge (2005). The method involves correction function (*CF*) for endogenous variables (finance variables in this case), and the interaction terms of endogenous variables and exogenous covariates Financejj* (Xi-u(Xi)). A statistically significant interaction term (abbreviated to *iv_for*, *iv_sfr* or *iv_bl*) is the evidence in favour of the hypothesis of endogeneity.

Note 4: All estimations include the full sets of industry and regional dummies, both of which are jointly significant in all specifications.

3.5.5 Further analysis: firm capital structure, growth and level of finance

Having tackled the question "does capital structure matter to firm growth"? I now consider whether the *level* of finance affects the relationship between capital structure and firm growth. To my knowledge there are no theoretical or empirical studies that attempt to address this issue. But a reasonable conjecture would be that when a firm does not have much capital, its demand for finance is high and the capital structure should not matter much. On the other hand, when a firm has access beyond a certain threshold of capital, financing from a particular source may be preferable and capital structure might be more important for firm growth.

To investigate whether the level of capital modifies the relationship between firm growth and capital structure, I first re-estimate the baseline model with interactive terms of the capital structure variables with total finance and its square terms. Table 8 reports the estimation results from outlier robust regressions. The coefficients of all the interactive terms of the finance variables with total finance are mostly negative and highly significant, and those of the squared interactive terms are positive. This means that the importance of capital structure on growth first declines as total finance increases, but then it starts to increase after some level of finance. There are a few exceptions though. Total level of finance does not seem to affect how state budget promotes COEs' growth, and the impact of foreign finance on private firms' growth is monotonically decreasing with the level of total finance.

Table 8: Capital Structure, Firm Growth and Level of Finance (1)

Dep. var: Employment Growth	Outlier Robust Regression				
Variables	Overall	SOEs	Collectives	Private	FIEs
Foreign finance	0.0706***	0.102***	0.0276	-0.00281	0.0535***
	(0.0031)	(0.0045)	(0.018)	(0.014)	(0.0095)
Self-raised finance	0.0406***	0.0160***	0.0172	0.0264***	0.0561***
	(0.0027)	(0.0049)	(0.013)	(0.0056)	(0.0089)
Bank loan	0.0293***	0.0124***	0.0248*	0.0164**	0.0459***
	(0.0029)	(0.0044)	(0.013)	(0.0064)	(0.012)
Foreign finance×Total finance	-0.00132***	-0.00523***	-0.0123**	-0.00380**	-0.00118***
	(0.00029)	(0.00074)	(0.0048)	(0.0016)	(0.00045)
(Foreign finance×Total finance)^2	0.0000137***	0.0000515***	0.000275	0.00000557	0.00000681**
	(0.0000017)	(0.0000059)	(0.00020)	(0.000014)	(0.0000032)
Self-raised finance×Total finance	-0.00653***	-0.00647***	-0.00834***	-0.00393***	-0.00516***
	(0.00025)	(0.00038)	(0.00087)	(0.00046)	(0.00065)
(Self-raised finance×Total finance)^2	0.0000151***	0.00000544***	0.0000186***	0.0000102***	0.0000116***
	(0.00000083)	(0.00000053)	(0.0000047)	(0.0000021)	(0.0000021)
Bank loans×Total finance	-0.00263***	-0.00324***	-0.00825***	-0.00321***	0.000119
	(0.00013)	(0.00022)	(0.0014)	(0.00027)	(0.00041)
(Bank loans×Total finance)^2	0.00000413***	0.00000891***	0.000147***	0.00000364***	-0.00000249*
	(0.00000015)	(0.00000029)	(0.000031)	(0.00000041)	(0.0000015)
State budget×Total finance	-0.00675***	-0.00465***	-0.00944	-0.00869***	-0.00592***
	(0.00015)	(0.00024)	(0.011)	(0.00042)	(0.0013)
(State budget×Total finance)^2	0.00000656***	0.00000170***	0.000400	0.0000236***	0.00000680
	(0.00000014)	(0.00000018)	(0.00094)	(0.0000013)	(0.000020)
Age	-0.000460***	0.000990***	0.0000566	-0.00131***	-0.00797***
	(0.000078)	(0.00012)	(0.00025)	(0.00018)	(0.00057)
Age-squared	0.000198	-0.00215***	-0.00143	0.00144**	0.0290***
	(0.00021)	(0.00025)	(0.0011)	(0.00066)	(0.0029)
Size	-0.484***	-0.429***	-0.534***	-0.469***	-0.537***
	(0.0013)	(0.0025)	(0.0025)	(0.0026)	(0.0032)
Size-squared	0.0421***	0.0361***	0.0483***	0.0406***	0.0480***
	(0.00016)	(0.00029)	(0.00031)	(0.00030)	(0.00039)
TFP	0.0358***	0.0466***	0.0275***	0.0310***	0.0289***
	(0.00055)	(0.00098)	(0.0012)	(0.0010)	(0.0014)
Growth of Capital	0.0374***	0.0604***	0.0261***	0.0302***	0.0275***
	(0.00043)	(0.00084)	(0.00088)	(0.00074)	(0.0011)
Exporting Intensity	0.0537***	0.0560***	0.0378***	0.0610***	0.0366***
	(0.0010)	(0.0019)	(0.0034)	(0.0030)	(0.0025)
Innovation Intensity	-0.00133	-0.0180*	-0.00937	0.0144**	-0.00444
	(0.0042)	(0.0092)	(0.011)	(0.0066)	(0.0084)
Labour quality	0.0277***	0.0112***	0.0452***	0.0399***	0.0200***
	(0.00024)	(0.00039)	(0.00065)	(0.00040)	(0.00076)
Collective Dummy	0.0195***				
	(0.0022)				
Private Dummy	0.0355***				
	(0.0021)				
Foreign Dummy	0.00496**				
	(0.0022)				
Central Area	0.0162***	0.0347***	0.0150***	0.00744***	-0.00523
	(0.0015)	(0.0029)	(0.0024)	(0.0025)	(0.0054)
West Area	0.0109***	0.0157***	0.00132	0.0162***	-0.00597
	(0.0019)	(0.0034)	(0.0036)	(0.0031)	(0.0074)
Constant	1.212***	1.115***	1.317***	1.207***	1.385***
	(0.0036)	(0.0062)	(0.014)	(0.0082)	(0.012)
Observations	166975	41790	38668	64067	22444
R-squared	0.75	0.78	0.80	0.64	0.82

Note 1: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Note 2 All estimations include the full sets of industry and regional dummies, both of which are jointly significant in all specifications.

One potential problem is the possible endogeneity of both financial structure and total level of finance. Unfortunately the problem of mixed discrete and continuous endogenous variables is not yet tackled within the modified control function approach. As an alternative estimation strategy, I break down the overall sample into six quantiles according to the level of firms' total finance, using the 10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th} percentiles as boundaries. I then estimate the baseline growth model for each quantile by robust regression and MCF with selection mechanism following exactly the same methodology detailed in Section 3.4.2. The purpose is to test if the marginal effects of the finance variables vary across the quantiles of total finance level. If they do, then one can conclude that the level of finance plays a role in the relationship between capital structure and firm growth.

The robust regression results given in Table 9 suggest that the coefficients of foreign investment and self-raised finance first decrease and then rise along the quantiles, consistent with the U-shaped relationship found in Table 8. Introducing a selection and endogeneity correction, however, alters this pattern. The general tendency is that the contribution of foreign finance and self-raised finance to firm growth increase as total finance increases untill the 50^{th} percentile, after which it starts to decline. Thus for firms at the lowest and highest quantiles, the source of finance in their capital structure does not seem to matter as much as it does for firms located in the median quintiles of the total capital distribution.

Table 9: Capital Structure, Firm Growth and Level of Finance (2)

Dep. var: Employment Growth	Outlier Robust Regression						MCF, select					
Variables	Q=0.1	Q=0.25	Q=0.5	Q=0.75	Q=0.9	Q=1	Q=0.1	Q=0.25	Q=0.5	Q=0.75	Q=0.9	Q=1
Foreign finance	0.0519**	0.0610***	0.0299***	0.0392***	0.0439***	-0.00482	0.0778	0.0575**	0.0605**	0.0782**	0.0674***	0.00466
	(0.022)	(0.014)	(0.0068)	(0.0053)	(0.0059)	(0.0071)	(0.092)	(0.024)	(0.019)	(0.017)	(0.019)	(0.036)
Self-raised finance	0.0263***	0.0272***	0.0290***	0.0195***	0.0203***	0.00366	0.0665*	0.0380*	0.0426**	0.0410**	0.0238**	-0.00322
	(0.0098)	(0.0086)	(0.0059)	(0.0049)	(0.0055)	(0.0060)	(0.035)	(0.022)	(0.017)	(0.012)	(0.011)	(0.018)
Bank loans	-0.00510	0.0137	0.0179***	0.00737	0.0182***	0.00824	-0.0423	-0.00492	0.00236	0.00564	-0.000263	-0.0503**
	(0.013)	(0.010)	(0.0064)	(0.0052)	(0.0057)	(0.0062)	(0.055)	(0.024)	(0.017)	(0.014)	(0.013)	(0.023)
Age	-0.00101*	-	-0.00101***	-0.00132***	-	0.000159	-	-0.00118	0.00210*	0.000124	0.00134	0.00109
	(0.00059)	(0.00034)	(0.00025)	(0.00021)	(0.00022)	(0.00013)	(0.0037)	(0.0012)	(0.0011)	(0.00097)	(0.0012)	(0.00087)
Age-squared	0.00203	0.00227**	0.00131***	0.00133***	-0.000126	-	0.0150**	0.00598**	-0.00172	0.00219*	-0.00126	0.000462
	(0.0013)	(0.00067)	(0.00048)	(0.00037)	(0.00036)	(0.00011)	(0.0063)	(0.0026)	(0.0016)	(0.0013)	(0.0016)	(0.00075)
Size	-0.496***	-0.556***	-0.564***	-0.569***	-0.553***	-0.526***	-	-0.574***	-	-	-0.565***	-0.541***
	(0.0054)	(0.0046)	(0.0031)	(0.0027)	(0.0030)	(0.0032)	(0.037)	(0.013)	(0.014)	(0.013)	(0.013)	(0.021)
Size-squared	0.0518***	0.0573***	0.0555***	0.0523***	0.0463***	0.0368***	0.0924**	0.0506***	0.0474**	0.0441**	0.0427***	0.0356***
	(0.00082)	(0.00064)	(0.00041)	(0.00032)	(0.00032)	(0.00029)	(0.0043)	(0.0018)	(0.0016)	(0.0013)	(0.0012)	(0.0020)
TFP	0.0380***	0.0278***	0.0294***	0.0259***	0.0319***	0.0372***	-0.0292	0.0288***	0.0254**	0.0307**	0.0413***	0.0341***
	(0.0024)	(0.0018)	(0.0012)	(0.0010)	(0.0011)	(0.0011)	(0.026)	(0.0063)	(0.0081)	(0.0097)	(0.013)	(0.0081)
Growth of Capital	0.0292***	0.0204***	0.0196***	0.0207***	0.0225***	0.0220***	-0.00893	0.0351***	0.0407**	0.0375**	0.0212***	0.0437***
	(0.0016)	(0.0013)	(0.0011)	(0.0011)	(0.0014)	(0.0014)	(0.0092)	(0.0036)	(0.0031)	(0.0034)	(0.0048)	(0.0095)
Exporting Intensity	0.0520***	0.0380***	0.0380***	0.0356***	0.0399***	0.0813***	0.0961**	0.0592***	0.0709**	0.0220	0.0105	0.00405
	(0.0050)	(0.0044)	(0.0032)	(0.0022)	(0.0018)	(0.0043)	(0.022)	(0.012)	(0.0079)	(0.026)	(0.011)	(0.073)
Innovation Intensity	-0.00532	0.00711	0.0329***	0.0132*	0.00282	-0.0109*	0.205**	0.0314	0.0545**	-0.00327	0.00252	-0.0633*
	(0.030)	(0.016)	(0.0098)	(0.0080)	(0.0079)	(0.0066)	(0.10)	(0.044)	(0.013)	(0.021)	(0.024)	(0.038)
Labour quality	0.0406***	0.0334***	0.0371***	0.0326***	0.0207***	0.0132***	0.0555**	0.0393***	0.0270**	0.0227**	0.0225***	0.00595
	(0.0017)	(0.0012)	(0.00088)	(0.00057)	(0.00045)	(0.00029)	(0.0088)	(0.0041)	(0.0050)	(0.0055)	(0.0043)	(0.0041)
Collective Dummy	0.0834***	0.0443***	0.0143***	0.00657*	-0.00662	0.00689	0.169***	0.0855***	0.0748**	0.0710**	0.0469**	0.0963***
	(0.0098)	(0.0079)	(0.0049)	(0.0039)	(0.0044)	(0.0054)	(0.052)	(0.018)	(0.016)	(0.017)	(0.022)	(0.022)
Private Dummy	0.0904***	0.0560***	0.0283***	0.0250***	0.0193***	0.0103***	0.239**	-0.0115	0.0284	0.0244*	0.0357***	0.0598***
	(0.0097)	(0.0077)	(0.0048)	(0.0037)	(0.0040)	(0.0039)	(0.093)	(0.019)	(0.018)	(0.014)	(0.010)	(0.012)
Foreign Dummy	0.0607***	0.0457***	0.0239***	-0.00925**	-	-0.0419***	0.387***	0.0476**	0.00506	-	-	-0.0623***
	(0.021)	(0.012)	(0.0051)	(0.0036)	(0.0038)	(0.0042)	(0.081)	(0.024)	(0.015)	(0.012)	(0.011)	(0.014)
Central Area	0.0373***	0.0132***	0.00824***	0.0113***	0.0153***	0.0106***	0.143***	0.0232**	0.0217**	0.0143**	0.0130	0.0219*
	(0.0060)	(0.0043)	(0.0028)	(0.0026)	(0.0032)	(0.0036)	(0.018)	(0.011)	(0.0059)	(0.0053)	(0.0081)	(0.011)
West Area	0.00582	-0.00733	0.00305	0.0106***	0.0173***	0.0166***	-	-0.0143	0.0193**	0.0338**	0.0293***	0.0437***
	(0.0078)	(0.0057)	(0.0038)	(0.0033)	(0.0038)	(0.0041)	(0.022)	(0.012)	(0.0080)	(0.0070)	(0.0075)	(0.0091)
Selection mechanism (atanh(***rho***))							-0.151	-0.874***	-	-	-0.751**	-0.684***
							(0.43)	(0.057)	(0.25)	(0.29)	(0.37)	(0.14)
IV_for							-1.49***			0.119***		-0.99***
							(0.23)			(0.046)		(0.22)
IV_srf							-5.57***					
							(1.07)					
IV_bl												-3.72***
												(0.99)
	1.002***	1.186***	1.284***	1.418***	1.510***	1.715***	1.905***	1.580***	1.517***	1.574***	1.744***	2.173***
	(0.013)	(0.011)	(0.0079)	(0.0078)	(0.010)	(0.012)	(0.29)	(0.037)	(0.087)	(0.086)	(0.10)	(0.092)
Observations	12168	22822	40490	43687	28056	19752	16889	26549	46675	49010	30876	22033

Note 1: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Note 2: The reported selection mechanism (atanh(***rho***)) is the inverse hyperbolic tangent of the correlation coefficient ***rho*** between residual terms of main equation and selection equation, i.e. atanh(rho)=0.5[ln(1+rho)/(1-rho)]. The test of atanh(rho) is equivalent to the test of rho=1. Insignificant atanh(rho) indicates that selectivity bias is negligible.

Note 3: MCF refers to modified control function approach due to Wooldridge (2005). The method involves correction function (*CF*) for endogenous variables (finance variables in this case), and the interaction terms of endogenous variables and exogenous covariates Financejj* (Xi-u(Xi)). A statistically significant interaction term (abbreviated to *iv_for*, *iv_sfr* or *iv_bl*) is the evidence in favour of the hypothesis of endogeneity.

Note 4: All estimations include the full sets of industry and regional dummies, both of which are jointly significant in all specifications.

3.5.6 Sensitivity to alternative definition of the capital structure variables

This section investigates the sensitivity of the results presented in this chapter to an alternative definition of capital structure. Based on the financing share variables, a set of dummy variables are generated to indicate firm's major financing source of capital, referred to as *financing choice*. For example, a financing choice of bank loan takes the value of one, if bank loan represents the largest financing source in total finance. According to this definition, a firm has only one major financing choice, so the firms with evenly distributed financing sources are dropped out from the sample. While it might not be a perfect measure, this way of defining the financing choice variables provides an alternative way of looking at the efficiency of the various sources of finance.

To deal with potential endogenous bias of the financing choice variables, the MCF estimator discussed in Section 3.4.2 has to be modified to take into account that the endogenous variables are now binomial. The detail of the estimation technique, which is also due to Wooldridge (2005), is given in Appendix 3.

Table 10 presents the results for the overall sample and sub-samples defined by ownership structure. Both robust outlier regression and MCF estimates are very much in line with the findings presented in Table 4 and Table 5. The only notable exception is the finding from the MCF model, which indicates that the choice of financing does not matter for private firms.

Table 10: Sensitivity to alternative definition of capital structure variables

Dep var.: employment growth	Outlier robust	MCF,select	Outlier robust				MCF,select			
Variables	Overall sample		SOEs	Collectives	Private firms	FIEs	SOEs	Collectives	Private firms	FIEs
Foreign finance	0.0562***	0.0606***	0.0888***	0.00754	-0.0186	0.0259***	0.0749***	0.00787	-0.00668	0.0320***
	(0.0026)	(0.012)	(0.0041)	(0.012)	(0.012)	(0.0048)	(0.011)	(0.043)	(0.026)	(0.010)
Self-raised finance	0.0333***	0.0443***	0.00968**	-0.00154	0.0182***	0.0314***	0.0201**	0.0279	0.00691	0.0461***
	(0.0022)	(0.0069)	(0.0045)	(0.0059)	(0.0038)	(0.0050)	(0.0091)	(0.018)	(0.012)	(0.012)
Bank loans	0.0227***	0.0237***	0.00704**	0.00131	0.00895**	0.0247***	-0.00184	0.0179	-0.00270	0.0467***
	(0.0021)	(0.0059)	(0.0030)	(0.0062)	(0.0042)	(0.0065)	(0.0065)	(0.019)	(0.011)	(0.013)
Age	-0.000308***	0.00101*	0.00140***	0.000190	-0.000968***	-0.00773***	0.00209***	0.00957***	0.00155	-0.000433
	(0.000078)	(0.00061)	(0.00012)	(0.00025)	(0.00018)	(0.00057)	(0.00043)	(0.0032)	(0.0011)	(0.0033)
Age-squared	-0.0000348	0.00103	-0.00293***	-0.00167	0.000233	0.0276***	-0.00123	-0.0331***	-0.00458**	0.0190
	(0.00011)	(0.0019)	(0.00026)	(0.0011)	(0.00065)	(0.0029)	(0.00089)	(0.012)	(0.0021)	(0.016)
Size	-0.473***	-0.462***	-0.410***	-0.530***	-0.446***	-0.536***	-0.420***	-0.511***	-0.499***	-0.586***
	(0.0014)	(0.0081)	(0.0025)	(0.0025)	(0.0025)	(0.0032)	(0.0067)	(0.015)	(0.012)	(0.014)
Size-squared	0.0398***	0.0357***	0.0655***	0.0940***	0.0738***	0.0940***	0.0309***	0.0469***	0.0379***	0.0511***
	(0.00015)	(0.00098)	(0.00056)	(0.00060)	(0.00056)	(0.00077)	(0.00071)	(0.0021)	(0.0013)	(0.0017)
TFP	0.0354***	0.0503***	0.0467***	0.0261***	0.0297***	0.0282***	0.0434***	0.0539***	0.0487***	0.0244**
	(0.00057)	(0.0034)	(0.00099)	(0.0012)	(0.0010)	(0.0014)	(0.0035)	(0.010)	(0.0053)	(0.0096)
Growth of Capital	0.0344***	0.0735***	0.0587***	0.0222***	0.0270***	0.0230***	0.0728***	0.0590***	0.0518***	0.0225***
	(0.00042)	(0.0025)	(0.00083)	(0.00083)	(0.00072)	(0.0010)	(0.0021)	(0.0082)	(0.0024)	(0.0047)
Exporting Intensity	0.0630***	0.0942*	0.0690***	0.0402***	0.0633***	0.0409***	0.0264*	0.183***	0.0407	0.0824***
	(0.0010)	(0.050)	(0.0019)	(0.0034)	(0.0030)	(0.0025)	(0.014)	(0.030)	(0.028)	(0.020)
Innovation Intensity	-0.0125***	-0.0186	-0.0263***	-0.0144	0.00844	-0.0154*	0.0400*	-0.0266	0.0250**	0.0432
	(0.0043)	(0.026)	(0.0094)	(0.011)	(0.0066)	(0.0083)	(0.023)	(0.11)	(0.012)	(0.047)
Labour quality	0.0254***	0.00529***	0.0105***	0.0433***	0.0384***	0.0194***	0.00739***	0.0249	0.0127***	0.00630
	(0.00025)	(0.0015)	(0.00040)	(0.00065)	(0.00040)	(0.00076)	(0.0011)	(0.022)	(0.0032)	(0.0084)
Collective Dummy	0.0216***	0.0701***								
	(0.0021)	(0.0082)								
Private Dummy	0.0357***	0.0142*								
	(0.0020)	(0.0078)								
Foreign Dummy	0.00794***	-0.0701***								
	(0.0022)	(0.0064)								
Central Area	0.0159***	0.0251***	0.0377***	0.0164***	0.00778***	-0.00817	0.0393***	0.0307***	0.0186***	-0.0134
	(0.0015)	(0.0046)	(0.0030)	(0.0024)	(0.0025)	(0.0054)	(0.0064)	(0.0064)	(0.0060)	(0.011)
West Area	0.0101***	0.0247***	0.0151***	0.00315	0.0186***	-0.00903	0.0394***	0.0160*	0.0481***	0.0389***
	(0.0019)	(0.0045)	(0.0034)	(0.0035)	(0.0031)	(0.0070)	(0.0055)	(0.0093)	(0.0060)	(0.011)
Selection mechanism		-0.830***					-0.931***	-0.903***		-0.571***
(atanh(***rho***))		(0. 025)					(0.065)	(0.21)		(0.16)
IV_for		-0.065***						0.43***		-0.358***
		(0.024)						(0.16)		(0.083)
IV_srf		0.177***						-0.68***		0.390***
		(0.024)						(0.19)		(0.13)
IV_bl		-0.094**					-0.402***	0.426**		-0.240***
		(0.045)					(0.049)	(0.17)		(0.076)
Constant	1.211***	1.416***	1.091***	1.337***	1.183***	1.421***	1.454***	1.343***	1.535***	1.587***
	(0.0037)	(0.026)	(0.0062)	(0.0089)	(0.0071)	(0.0099)	(0.031)	(0.081)	(0.072)	(0.057)
Observations	164044	186348	42288	39087	64626	22554	42268	38053	63437	21598

Note 1: See section 5.6 for the alternative definition of the capital structure variables.

Note 1: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Note 2: The reported selection mechanism (atanh(***rho***)) is the inverse hyperbolic tangent of the correlation coefficient ***rho*** between residual terms of main equation and selection equation, i.e. atanh(rho)=0.5[ln(1+rho)/(1-rho)]. The test of atanh(rho) is equivalent to the test of rho=1. Insignificant atanh(rho) indicates that selectivity bias is negligible.

Note 3: MCF refers to modified control function approach due to Wooldridge (2005). The method involves correction function (*CF*) for endogenous variables (finance variables in this case), and the interaction terms of endogenous variables and exogenous covariates Financejj* (Xi-u(Xi)). A statistically significant interaction term (abbreviated to *iv_for*, *iv_sfr* or *iv_bl*) is the evidence in favour of the hypothesis of endogeneity.

Note 4: All estimations include the full sets of industry and regional dummies, both of which are jointly significant in all specifications.

3.6 SUMMARY AND CONCLUSIONS

Using a comprehensive firm-level dataset spanning the period of 1999-2002, this chapter provides a thorough investigation of the relationship between capital structure and firm growth in the Chinese manufacturing industry. This is an important contribution considering that China is a major transitional economy that has achieved remarkable economic growth, in spite of a rather underdeveloped financial system.

Various model specifications and econometric issues, and a number of ways of slicing the data (e.g. by ownership, size, location and quantiles of capital) are considered with the view of establishing the robustness of the results. The main findings are the following. First of all, capital structure does matter to firm growth, and in different ways among different types of firms. Second, foreign investment, self-raised finance, and bank loan have significant and robust growth-enhancing effects compared to state budgets. In many cases, there is a pecking order in the marginal effects of financing sources, which, in a decreasing order, runs from foreign investments to self-raised finance, then bank loans and finally to state budget. Third, the relation between capital structure and firm growth is mediated by firm characteristics. For example, foreign investment is the most efficient financing channel for SOEs growth, while bank loans and state finance are almost equally less effective. Fourth, the remarkably robust effect of self-raised finance on firm growth offers evidence of the existence of an important informal financial mechanism in China. Finally, the chapter demonstrates that neglecting issues of sample selectivity and endogeneity of capital structure is likely to lead to erroneous inference.

The results confirm that state-owned financial institutions lack efficiency in allocating financial resources. The policy implication will be to recommend financial reforms to enhance the efficiency of state-owned banks in intermediating saving and directing it to more productive investments. With a national savings rate of approximately 40%, a healthy current account surplus and ample reserves, it is not as if there is a lack of funds in China.

On the other hand, the relative efficiency of self-raised finance in promoting firm growth suggests that the development of a broader financial system deserves more attention. An efficient informal financial mechanism not only provides an alternative vehicle for saving and financing firms, especially those in non-state sector and smaller firms, but can also be a catalyst for banking reforms by exposing state banks to market competition.

In spite of the many contributions of this chapter, it is clear that additional work is required for a better understanding of the relationship between finance and firm performance in China. I conclude this chapter by suggesting two potentially fruitful research topics in this area. First, data permitting, it would be interesting to provide an analysis of the service sector, given its increasing importance as a source of growth in China. Secondly, a systematic analysis of the impact of access to finance on the various channels of firm growth, such as innovation, labour training and exporting could be carried out. The final chapter of the thesis makes some progress in this direction by investigating the interaction between access to domestic finance, foreign direct investment and the exports of private firms in China.

APPENDIX

Appendix 1: TFP measurement

Chapters 3 and 4 adopt the widely employed methodology of Levinsohn and Petrin (2003). Based on Olley and Pakes (1996), who address the simultaneity between firm's input levels and unobserved productivity shocks and propose the use of an investment proxy to control for the correlation, Levinshon and Petrin (2003) suggest the use of firm's raw material inputs as proxies instead. They argue that intermediate inputs are less costly to adjust, and thus may respond more fully to productivity shocks. Moreover, if the demand function for intermediate inputs is monotonic in the firm's productivity for all relevant levels of capital, then raw material can serve as a valid proxy. This approach has the advantages of controlling for the simultaneity between firm's input choice and productivity shocks in the production function, and pursuing consistent productivity estimation without large truncation of the available data caused by a zero-value investment. What follows is the estimation procedure.

Assuming a Cobb-Douglas production function, the value-added based production function for firm i at time t can be written as:

$$\begin{aligned} y_{it} &= \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + \varepsilon_{it} \\ &\equiv \beta_l l_{it} + \phi_t(k_{it}, m_{it}) + \varepsilon_{it} \end{aligned}$$

where y is log of value added, which is defined as sales, net of intermediate inputs (m), l is labour input and k is capital input, and $\phi_t \equiv \phi_t(k_{it}, \omega_{it}) = \beta_0 + \beta_k k_{it} + \omega_{it}(k_{it}, m_{it})$ is an unknown function of capital and intermediate inputs. ϕ_t is strictly increasing in the productivity shock ω_{it}, so that it can be inverted and can be written as $\omega_{it} = \omega_t(i_{it}, k_{it})$ for some function ω_t. Levinshon and Petrin (2003) approximate $\phi_t(k_{it}, m_{it})$ by a third order polynomial in k and m, $\sum_{j=0}^{3}\sum_{s}^{3} \delta_{js} k_{it}^{j} m_{it}^{s}$ to obtain an estimate of β_l and ϕ_t (up to the intercept) via OLS. This constitutes the first stage of the estimation procedure. At the second stage the

elasticity of capital β_k is defined as the solution to $\min_{\beta_k^*} \sum_i \sum_t \left(y_{it} - \hat{\beta}_l l_{it} - \beta_k^* k_{it} - \varpi_{it} \right)^2$, where ϖ_{it} is a nonparametric approximation $E[\omega_{it} \mid \omega_{it-1}]$. Since the estimators involve two stages, the calculations of the covariance matrix of the parameters must allow for the variation due to all of the estimators in the two stages. Levinshon and Petrin (2003) note that the derivation of the analytical covariance matrix is quite involved, and suggest the use of bootstrap methods to estimate standard errors. In this study 250 bootstrap replications are performed. Once consistent estimates of the input elasticity are at hand, the logarithm of productivity can be obtained as $\hat{\omega}_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it}$.

Appendix 2: The classification and definition of different types of Chinese firms

Following the classification convention of Chinese National Statistics Bureau, and "regulation of the People's Republic of China (PRC) on the Management of Registration of Corporate Enterprises." (Short for "Regulation"), as well as the previous literature, I classify the firms into the state-owned enterprises, collectively owned enterprises, domestic private enterprises and foreign invested firms. It is noteworthy that there are few advances on a reasonable classification beyond the traditional breakdown, which is another attempt I are making. The details are following.

State-owned enterprises (SOEs)

This group mainly includes registered SOEs according to the Regulation. These are non-corporate economic units where the entire assets are owned by the state. The state government therefore assigns managers to run the enterprise; and state banks (used to be government agent and now still under government control) construct and enforce the credit plans.

Collectively owned enterprise (COEs)

COEs are the economic units such that collectives own the assets. The collective here means the community in the city or rural area. COEs are normally under local governments' supervision. However, since local government can be considered as the agent of central government, any firm owned by local government is also owned by central government. Township-village enterprises (TVEs) are included in this group that locate in rural areas and collectively owned or with most of its investment from residents in these rural areas. TVEs are not distinguished from other COEs in this chapter.

Domestic private enterprises (private firms)

Domestic private firms, include all the other types of firms except from SOEs, COEs and foreign invested firms. These firms can be jointly owned firms, share-holding corporations, limited liability companies, and individually owned firms and so on. These firms can be solely private funded enterprises, private cooperative enterprises, private limited liability

corporations, private share-holding Corporation limited, and other limited companies. These economic units are all registered as private individual enterprises according to the Regulation.

Foreign invested enterprises (FIEs)

Foreign-invested firms refer to the enterprises invested by foreign investments, and foreign investments must be more than 25% of registered assets according to the Regulation. This group includes FIEs with investments both from Hong Kong, Tai Wan and Macau and foreign countries.

Table A2. The classification of ownership

State-owned enterprises (SOEs)
State owned enterprises (Guo you qi ye)
Joint state-owned enterprises (Guo you lian ying qi ye)
Joint state and collective-owned enterprises (Guo you yu ji ti lian ying qi ye)
Limited liability corporations which are solely funded by the state (Guo you du zi gong si)
Collectively owned enterprises (COEs)
Collectively owned enterprises (Ji ti qi ye)
Joint collectively owned enterprises (Ji ti lian ying qi ye)
Cooperative enterprises (Gu fen he zuo qi ye)
Other joint ownership enterprises (Qi ta lian ying qi ye)
Domestic Private enterprises (Private firms)
Solely private funded enterprises (Si ying du zi qi ye)
Private cooperative enterprises (Si ying he huo qi ye)
Private limited liability corporations (Si ying you xian ze ren gong si)
Private share-holding corporations limited (Si ying gu fen you xian gong si)
Other Limited liability corporations (Qi ta you xian ze ren gong si)
Share holding companies (Gu fen you xian dong si)
Foreign invested enterprises (FIEs)
FIEs – invested by Hong Kong, Macau, and Tai Wan
FIEs - invested by foreign owned firms

Appendix 3: Potential endogeneity of finance variables

To deal with multiple binomial endogenous variables, I apply Wooldridge's (2005) modified control function (MCF) approach. The idea is to generate the expected *correction functions* (CF) $h(X,Z,\theta)$ to serve as instrumental variables for the correction of omitted variables bias. In the case of four binary finance choice variables, it is assumed that $Finance_j$, j=1,2,3,4 is a set of binary indicators each of which follows a standard probit reduced form:

$$Finance_{ij} = 1\left[\theta_0' + \theta_1' X_i + \theta_2' Z_i + \upsilon_i\right],\ \upsilon \mid X,Z \sim \text{Normal}(0,1),$$

where X is as before the covariates vector while Z is a vector of available instrumental variables, which are assumed to be exogenous and redundant to determine firm growth in the structural conditional expectation. Vector X and Z are defined as in section 4.2. The control function $h_j(X,Z,\theta)$it can be obtained by:

$$h_j(X,Z,\theta) = E(Finance_j \cdot \upsilon \mid X,Z) = \int_{-\infty}^{\infty} 1[r\theta + \upsilon \geq 0]\upsilon\phi(\upsilon)d\upsilon$$
$$= \int_{-r\theta}^{\infty} \upsilon\phi(\upsilon)d\upsilon = -\phi(\upsilon)\,|_{-r\theta}^{\infty} = \phi(-r\theta) = \phi(r\theta),$$

where $r = (1,X,Z)$, and $\phi(.)$ is the standard normal density. Therefore, one can add to the original equation (1) four terms of the form $\hat{\phi}_{ij} = \phi(r_i\hat{\theta}_j)$, $r_i \equiv (1,x_i,z_i)$:

$$GROWTH_i = \alpha + \beta' X_i + \sum_j \chi_j' Finance_{ij} + \sum_j \delta_j' Finance_{ij}(X_i - \bar{X}) + \sum_j \rho_j \hat{\phi}_{ij} + \lambda' D_i + \varepsilon_i$$

The above model will be estimated by least squares with bootstrapped standard errors.

Appendix Table 1: Industrial distribution of the sample firms

Industry	Average number of observations (1999~2002)	Fraction (%)				
		Total	State-owned firms	Collective-owned firms	Non-state-owned firms	Foreign invested firms
1. Food industry	25,380	15.2	20.6	14.9	13.2	10.2
2. Textile industry	22,876	13.7	9.7	13.1	14.3	21.2
3. Timber industry	4,174	2.5	2.0	2.3	2.8	3.2
4. Papermaking and printing industry	10,519	6.3	7.3	6.7	5.5	6.2
5. Petroleum, chemical, and plastic products industry	22,041	13.2	10.3	14.1	14.5	13.7
6. Electric products industry	6,512	3.9	4.3	1.7	3.2	9.1
7. Metal, non-metal industry	29,054	17.4	12.1	23.7	19.4	12.9
8. Machinery	31,558	18.9	17.3	18.7	20.9	16.4
9. Medicine and medical equipments industry	3,340	2.0	2.0	1.2	2.4	2.3
10. Others	11,354	6.8	14.4	3.5	3.9	4.7
Total	166,976	100.0	100.0	100.0	100.0	100.0

Appendix Table 2: Geographical distribution of the sample firms

Economic Regions	Included Provinces and regions	Sample	
		Average number of Observations (1999-2002)	Percent (%)
Metropolis	Beijing, Tianjing, Shanghai	20,024	12.0
Northeast	Liaoning, Jilin, Heilongjiang	10,100	6.0
Coast	Hebei, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Hainan	88,030	52.7
Central	Shanxi, Anhui, Jiangxi, Henan, Hubei, and Hunan	30,305	18.1
Northwest	Inner Monglia, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang and Tibet	8,060	4.8
Southwest	Chongqing, Sichun, Yunnan, and Guangxi	10,457	6.3
Total		166,976	100.0

CHAPTER FOUR: MULTINATIONALS, ACCESS TO FINANCE AND EXPORTS

4.1 INTRODUCTION

This chapter considers the relation between finance and exports, and examines the impact of foreign direct investment (FDI) on the exporting behaviour of indigenous enterprises. This is motivated by the recent critiques of China's export-oriented FDI. China has won many plaudits for its rapid transformation from an autarky to the world's largest recipient of foreign direct investment (FDI)[35] and a regional export powerhouse. However, some economists, most notably Huang (2003, 2004), are less optimistic about the Chinese government's long-standing policy that encourages export-oriented FDI. Their main concern seems to be that foreign-invested enterprises (FIEs), especially those in labour-intensive industries, divert exports away from financially constrained indigenous private enterprises.

The Chinese banking system has a reputation of a lending bias against private firms (e.g. Allen *et al*, 2005). Until 1998, the four state-owned commercial banks which dominate the banking system in China[36] had explicit instructions not to lend to private enterprises. Huang (2003) contends that due to this financial repression, domestic private firms found it difficult to engage in contractual arrangements with foreign buyers[37], creating fertile conditions for foreign firms to extend equity financing instead. According to this line of argument, a large proportion of export-oriented FDI in China is a result of the inefficiency of the financial system, which favours stagnant state-owned enterprises over more dynamic private enterprises. As such, the huge flow of FDI into the country will not necessarily be an indicator of the strength of the economy.

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[35] See "Trends and Recent Developments in Foreign Direct Investment", OECD Directorate for Financial, Fiscal and Enterprise Affairs, June. 2004.

[36] These four banks are the only financial institutions that have branches in almost all locations in China, and by 2002 they accounted for nearly two thirds of loans outstanding and deposits (see Chapter two).

[37] For example, due to their inability to import machinery and equipment necessary to comply with an export contract.

Two questions will be addressed empirically in this chapter: (i) is there a link between access to finance and firms' exports? (ii) what is the impact of FDI on the exporting behaviour of indigenous enterprises?

The theoretical trade literature has examined the first question from different perspectives. Within an augmented Heckscher-Ohlin model, Kletzer and Bardhan (1987) offer a theory which predicts that countries with well functioning financial systems tend to export more goods produced in industries that are heavily dependent on external finance. More recently, Chaney (2005) shows that in the presence of fixed costs associated with exporting, some firms do not export because of liquidity constraints. The second question was the subject of Aitken, Hanson and Harrison (1997)'s empirical investigation, and their seminal work which is set in Mexico, has spawned related firm level studies across a variety of countries. This chapter contributes to the literature by modelling the interaction between access to external finance, FDI and individual firms' exports in what is arguably the most important emerging economy in the world.

There is vast literature that examines the relationship between aggregate growth and finance, but relatively little attention has been paid to the specific mechanisms linking finance and growth, especially at the micro level (see Levine 2005 for an extensive review)[38]. Thus, by focusing on firm level exports, this chapter also contributes to the research endeavour that seeks to shed empirical light on the various channels through which financial development might promote growth.

Utilizing the same data source as in the previous chapter, 28,000 domestic private enterprises from the Chinese manufacturing sector spanning the period 1999-2002 are examined. This is an interesting period since it coincides with China's accession to the WTO and the further opening up the economy to foreign investors. Controlling for the heterogeneity and endogeneity of FDI and access to finance, four key results emerge

[38] In an important paper based on cross country growth regressions, Alfaro et al (2004) find that financial development speeds up the rate of FDI-induced economic growth rates.

from the analysis: (i) access to bank loans is associated with greater export markets orientation, especially amongst politically unaffiliated firms in labour-intensive industries; (ii) export-oriented horizontal FDI has a robust export-enhancing effect, and this positive externality is more pronounced amongst firms with more finance; (iii) domestic market-seeking horizontal FDI has a deleterious effect on the export market orientation of indigenous firms; (iv) positive export spillovers through vertical linkages with multinational firms are few and far between.

The remainder of this chapter is structured as follows. Section 2 offers a short overview of the development of FDI in China. Section 3 discusses the theoretical literature linking FDI, finance and exports. Section 4 presents the empirical model, and Section 5 describes the data and offers some preliminary analysis. The main findings of the chapter are discussed in Section 6, and finally Section 7 concludes.

4.2 FOREIGN-INVESTED FIRMS IN CHINA

This section provides a brief overview of the trend of FDI flow into China over the past quarter of a century or so[39]. When the Chinese government initiated economic reforms in the late 1970s, FDI was allowed only in the designated four Special Economic Zones (SEZs)[40], where foreign investors were required to have local partners. At that time, Chinese policy makers saw FDI as an important vehicle for its export-led and import-substitution development strategy. As a result, the SEZs granted foreign investors concessionary tax policies, exemption from export and import duties for equipment and machinery employed in the production of export products.

Following the passage of the Wholly Foreign-Owned Enterprise Law in 1986, firms with 100% foreign capital were allowed to operate in the country for the first time and by 1988 China's Open Door Policy towards FDI extended the entire coastal zone.

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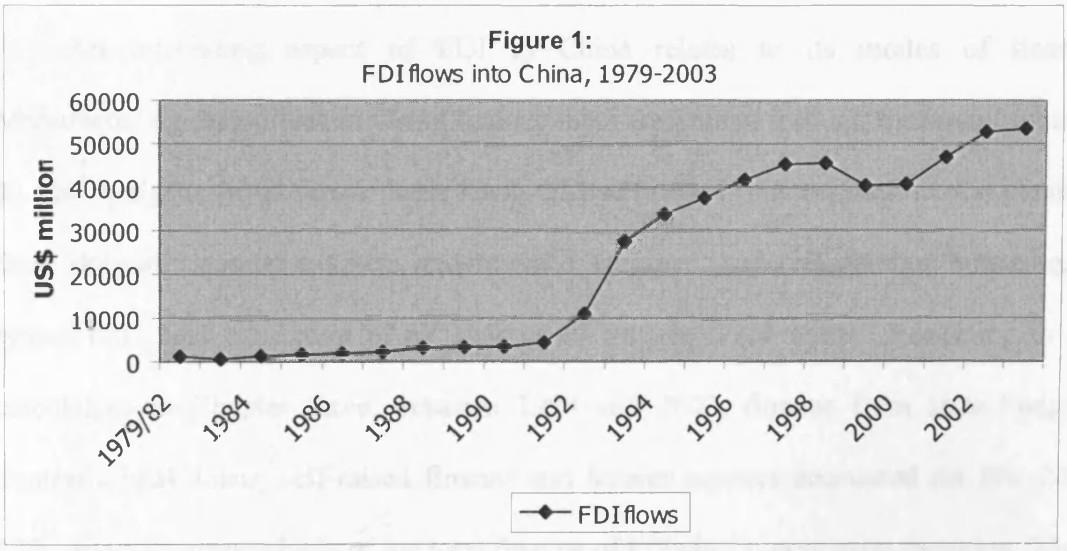
[39] Some of the material in this section draws on Chen (1997) and Lemoine (2000).
[40] The SEZs consisted of three in the Guangdong Province: Shenzhen, Zhuhai, Shantou, and Xiamen in Fujian Province.

The main purpose of this policy initiative was to develop labour-intensive industries that specialise in export processing of imported raw materials. This export-oriented FDI policy has evidently been spectacularly successful, as China is now described as "the export processing zone of the world" (Lin, 2002). Further liberalisation initiated in 1992 had resulted in a dramatic surge in multinational activity in China (see Figure 1). Foreign investors were offered better opportunities to sell their products in the domestic market. As policy makers started to view FDI as a channel of international knowledge transfer, which would minimise the need for technology imports, high-tech investors were particularly encouraged.

Figure 1: FDI flows into China, 1979-2003



Data Source: China Statistical Yearbook, various issues.

FDI in China is characterised by an uneven regional distribution. During the period 1987-2000, about 87% of cumulative FDI was located in the coastal regions (Wei, 2003). This was mainly a reflection of the initial policy that restricted FDI to coastal regions. The proximity of those regions to Hong Kong and Taiwan, which are the main sources of foreign investment especially at the initial stage of the economic reforms, also contributed to these geographical disparities. Although Western and Central regions have started gradually to attract more foreign investors, the skewed

distribution of FDI in favour of the eastern coastal regions has raised serious concerns that FDI might exacerbate existing regional inequalities (e.g. Bils, 2005).

Investment from the Chinese Diaspora of Hong Kong, Taiwan and Macao accounted for more than 60% of the total accumulated FDI stock in China between 1983 and 1998 (OECD, 2000). This investment is predominantly export-oriented and tends to be concentrated in labour intensive sectors. During this period, multinationals from Japan, USA and Western Europe represented 8.2%, 8.1% and 6.7% of FDI, respectively. Foreign investment originated from these OECD countries is likely to be allocated to capital-intensive sectors and is increasingly being motivated by the desire for access to the huge domestic market.

An interesting aspect of FDI in China relates to its modes of finance. Manufacturing enterprises in China finance their investment through four main sources: (i) state budgets; (ii) domestic bank loans, (iii) self-raised finance, such as that obtained from domestic capital markets and retained earnings, and (iv) foreign financing. A typical FIE uses a mixture of all sources of finance listed above. According to the calculation in Chapter three, between 1999 and 2002, finance from state budgets, domestic bank loans, self-raised finance and foreign sources accounted for 8%, 20%, 17%, and 55% respectively of the total finance of FIEs in Chinese manufacturing. These figures suggest that multinational firms operating in China make significant use of domestic financial resources.

4.3 ACCESS TO FINANCE, EXPORTS AND FDI: THEORETICAL CONSIDERATIONS

4.3.1 Access to finance and exports

International trade theory suggests financial sector development is a source of comparative advantage, and consequently a determinant of international trade flows. Kletzer and Bardhan (1987) start from traditional trade theories focusing on factor

endowment differences between coutries by introducing aspects of credit market imperfections in patterns of trade specialization. They show that when technology and endowments are identical between countries and economies of scale are absent, moral hazard considerations in the international credit market under sovereign risk and ineffective contract enforcement due to domestic institutional factors can lead to higher interest rate or rationed credit. These may further lead to comparative disadvantage in terms of higher requirements of working capital, marketing costs, or trade finance. Hence they predict that a country with a well-developed financial sector will have comparative advantage in the exports of goods produced in industries that rely more on external financing. Baldwin (1989) develops a model that considers finance as an instrument of risk diversification, and shows that firms in financially developed countries enjoy better opportunities for diversification, and therefore specialise in the export of risky goods[41]. Recently Chaney (2005) proposes a theory of international trade which predicts that in the presence of sunk costs associated with exporting, firms with liquidity constraints tend to be non-exporters.

Several channels through which finance generates growth have been identified in the theoretical literature. First, financial intermediaries are considered to be effective at picking entrepreneurs who are more likely to engage in innovative activities. The notion that finance plays a positive role in enhancing the rate of technological innovation dates back to Schumpeter, and recent authors who have explored this idea include De la Fuente and Martin (1996) and Morales (2003). Second, a well-functioning financial system has a positive influence on human capital accumulation. For example, Jacoby (1994) shows how access to credit facilitates the process of skill upgrading. Third, financial institutions stimulate economic development by monitoring managers and ensuring that effective corporate governance mechanisms are in place (e.g. Stiglitz and

[41] Beck (2002) and Svalerdy and Vlachos (2005) offer empirical evidence in support of the hypothesis that finance influences the pattern of international trade.

Weiss, 1983 and Myers and Majluf, 1984). This is expected to induce managers to maximise firm value rather than engage in rent-seeking transactions at the expense of shareholders. Fourth, theory suggests that debts diminish the amount of free cash flow to managers, giving them the incentive to reduce managerial slack and seek innovative ways to boost efficiency (e.g. Aghion et al, 1999). Finally, a well-functioning financial system can raise growth prospects by allowing individual agents to diversify and increase their propensity to undertake risky but high return projects. This idea is explored theoretically from different perspectives by Acemolglu and Zilibotti (1997) and King and Levine (1993), amongst others. In light of the well-established proposition that firms which are more efficient, fast growing, invest in technology and skill upgrading have a greater likelihood to export (e.g. Bernard et al 2003; Clerides et al, 1998 and Aw et al, 1999), it can reasonably be hypothesized that access to finance may enhance firms' propensity to export as long as it is growth-enhancing.

4.3.2 FDI and export spillovers

The mechanisms through which intra-industry spillovers from FDI occur are well understood in the literature (see Görg and Greenaway, 2004, for a recent review). The entry of multinational firms can have an impact on domestic firms' output, employment and efficiency through enhanced competition, technology diffusion, export market access and training of workers. In particular, FDI may stimulate the exports of domestic enterprises directly by providing information on international markets and marketing strategies or indirectly by enhancing the competitiveness of indigenous firms and demonstrating new management techniques (Aitken, Hanson and Harrison, 1997).

The early literature has focused on intra-industry FDI spillovers, but Rodríguez-Clare (1996) provides the first theoretical analysis of inter-industry linkage effects generated by multinationals. In a related paper, Markusen and Venables (1999) offer a model in which the entry of multinational firms has two contrasting effects on the

domestic economy: FDI crowds out domestic producers of final goods via a competition effect, but at the same time creates favourable conditions to indigenous firms via linkage effects by, for example, increasing the demand of intermediate goods. However, it is worth noting that neither Rodríguez-Clare (1996) nor Markusen and Venables (1999) have explicitly explored the link between export and FDI.

4.4 EMPIRICAL APPROACH

This section describes the empirical approach employed in this chapter to identify the relationship between FDI, access to finance and exporting intensity, defined as the share of exports in total sales. Firm *i* either exports at time *t* with positive exporting intensity or it does not. I formulate a Tobit model of exporting intensity in terms of a latent variable model as:

$$Export_{ijt} = \max[0, \gamma_1 X_{ijt} + \gamma_2 FDI_{jt} + \gamma_3 Bank_{ijt} + \gamma_4 (FDI_{jt} * Bank_{ijt}) + \gamma_5 D_{ijt} + \varepsilon_{ijt}],$$
$$\varepsilon \sim N(0, \sigma^2), \quad (1)$$

where FDI is a vector of indices of foreign presence[42] in industry j at time t; *Bank* denotes bank loan (normalised by total assets). X is a vector of firm level characteristics which comprise product innovation, firm age, productivity growth, labour training expenditure (normalised by total wage bills), size and self-raised finance (normalised by total assets). The choice of these control variables is guided by theoretical considerations and existing empirical evidence (e.g. Bernard and Jensen, 2004; Clerides et al, 1998 and Aw et al, 1999)[43], in which vertical FDI variables are also included. Finally D is the full set of industry, time and region dummies which are to control for differences in export-market participation between industries, over time (which might be caused by changes in foreign exchange rates and macroeconomic performance of the export market) and across regions (which are due to regional initial considitions that

[42] The construction and definition of the variables used the FDI indices will be discussed in more detail in the next section.

[43] The variable definitions are discussed in greater length in section 4.5 Data Description.

may be natural or policy-driven). Finally ε is a random error term.

Arguably, a number of regressors in Equation (1) such as horizontal FDI, firm size, productivity growth, labour training expenditure and bank loans are potentially endogenous. Foreign firms may be more likely to invest in sectors where domestic firms have a higher propensity to export. Also, exporting firms may have some unobserved characteristics which are systematically correlated with their ability to raise finance. These considerations motivate use of an instrumental variables technique for Tobit models as proposed by Smith and Blundell (1986)[44].

Lagged values of the endogenous regressors are used as instruments, together with three other additional external instruments. The first is a dummy variable indicating the political/bureaucratic affiliation of the firm, which is likely to be a relevant instrument for the finance variable[45]. It is noteworthy that political affiliations are normally assigned to firms when they are set up and therefore exogenous to the error term of the growth process, conditional on other covariates. The remaining two additional variables are designed to instrument both FDI and access to finance, and these are the output share of state-owned enterprises (SOEs) and the proportion of loss making SOEs in the firms' sector and region. These variables affect the extent of bank access by private firms, given the lending bias in favour of SOEs, particularly the poorly performing ones. On the other hand, Huang (2003) argues convincingly that a sizeable proportion of recent FDI (especially joint venture and acquisition FDI) in China has resulted from the insolvency problems facing SOEs. Thus it is reasonable to suppose that the output share of SOEs and the proportion of loss making SOEs are sensible instruments for FDI. The initial values of all three instruments are used to exclude the possible endogeneity.

The estimation of Tobit models with endogenous regressors involves two steps: (i)

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[44] Newey (1987) suggests a maximum likelihood estimator for discrete models with endogenous regressors. But his estimator fails to converge within my model – a commonly encountered problem when there is more than one endogenous regressor.

[45] Recall this has been explained in Chapter three.

running a linear regression of each endogenous regressor on the instrumental variable candidates and all other exogenous regressors, and (ii) estimating the Tobit model by including the residual terms from step (i) in the list of covariates. The residuals are correction terms for the endogeneity problem, and jointly significant coefficients on these terms can be taken as evidence in favour of the hypothesis that the relevant regressors are indeed endogenous.

I also experiment with the random effects panel data Tobit estimator for comparison purpose. Although this estimator does not control for the endogeneity of regressors, it does have the merit of allowing for within-firm serial correlation which is likely to arise from the persistence in unobserved firm characteristics affecting export orientation.

4.5 DATA DESCRIPTION AND PRELIMINARY ANALYSIS

The empirical analysis of this chapter is based on the same dataset used in Chapter three. To capture the extent of foreign presence in each industry j at time t, I define the degree of horizontal FDI in, say $HFDI_{jt}$, as the proportion of industry-region output accounted for by multinational companies[46]. This and all other indices of FDI are constructed for 171 three-digit industries within each of the 31 provinces of China. As a result, the FDI variables used in this chapter show very good sample variability.

Based on $HFDI_{jt}$ I calculate two indices of foreign presence in backward and forward linked industries in line with existing practice (cf. Smarzynska- Javorcik, 2004). Thus backward linkage with FDI in industry j at time t is a proxy for the foreign presence in the industries supplied by industry j at time t. It is computed as:

$$DFDI_{jt} = \sum_{\forall k \neq j} \alpha_{kj} HFDI_{kt} \qquad (2)$$

[46] Similarly horizontal FDI is also defined in the empirical literature as foreign equity participation weighted by output share and averaged over all firm in the sector (Smarzynska- Javorcik, 2004), or weighted by employment share instead (Aitken and Harrison, 1999).

where α_{kj} is the proportion of sector j's output supplied to industry k[47]. It is assumed that the greater the proportion of output supplied to an industry with foreign multinational presence, the greater the degree of linkage between foreign and local firms. I refer to this as *downstream FDI.*

The index of FDI in upstream sectors is calculated in a similar fashion as:

$$UFDI_{jt} = \sum_{\forall k \neq j} \beta_{kj} HFDI_{kt} \qquad (3)$$

where β_{kj} represents the proportion of sector k's output supplied to industry j. This measure of FDI, which I label *upstream FDI*, captures the extent of forward linkages local firms in downstream sectors have with MNEs in supplying sectors.

Each of the three FDI indices (viz. HFDI, DFDI and UFDI) is further distinguished by the market orientation of the foreign investment (domestic market seeking versus export-oriented), based on domestic market sales and exports reported by the multinational enterprises.

Table 1 gives the output share and exporting intensity of privately owned and foreign-owned firms in the database across two-digit industries during 1999 and 2002. It is apparent that FIEs (defined as those with at least 25% share of foreign capital) have significant presence in most industries. Industries particularly important to foreign investors include some high-tech industries such as Electronic & Telecommunications, but also more traditional manufacturing sectors such as Garments, Leather, and Timber Processing. Table 1 also shows that FIEs not only are highly export-oriented across all industries, but they also have substantial interest in serving domestic markets. It is also worth noting that between 1999 and 2002, the output share of private firms has more than doubled in most sectors.

[47] This information is obtained from the 1997 input-output table of China.

Table 1: Output share and export intensity of PRIVATE and foreign-invested enterprises (FIE) by industry

	PRIVATE firms				FIE enterprises			
	Output Share		Export intensity		Output Share		Export intensity	
Two-digit industry classification	1999	2002	1999	2002	1999	2002	1999	2002
13-Food Processing*	0.049	0.139	0.122	0.14	0.237	0.254	0.472	0.45
14-Food Production*	0.044	0.119	0.125	0.148	0.231	0.354	0.441	0.456
15-Beverage Industry*	0.038	0.115	0.132	0.136	0.299	0.33	0.434	0.468
17-Textile Industry*	0.043	0.135	0.143	0.166	0.365	0.331	0.43	0.45
18-Garments and Other Fibre Products*	0.045	0.11	0.148	0.159	0.47	0.492	0.434	0.433
19-Leather, Furs, Down and Related Products*	0.044	0.121	0.169	0.157	0.457	0.387	0.398	0.413
20-Timber Processing*	0.043	0.131	0.119	0.118	0.377	0.415	0.444	0.428
21-Furniture Manufacturing*	0.043	0.147	0.111	0.145	0.296	0.453	0.41	0.451
22-Papermaking and Paper Products*	0.042	0.122	0.147	0.142	0.239	0.488	0.407	0.428
23-Printing and Record Medium Reproduction*	0.046	0.099	0.128	0.144	0.259	0.282	0.412	0.459
24-Cultural, Educational and Sports Goods*	0.04	0.129	0.152	0.144	0.487	0.455	0.45	0.427
25-Petroleum Refining and Coking	0.046	0.127	0.09	0.129	0.137	0.264	0.45	0.449
26-Raw Chemical Materials and Chemical Products	0.034	0.123	0.12	0.148	0.292	0.242	0.443	0.467
27-Medical and Pharmaceutical Products	0.03	0.122	0.135	0.144	0.193	0.216	0.445	0.456
28-Chemical Fibre	0.054	0.149	0.113	0.128	0.389	0.332	0.451	0.453
29-Rubber Products*	0.041	0.133	0.115	0.152	0.26	0.416	0.43	0.408
30-Plastic Products*	0.047	0.091	0.141	0.155	0.357	0.279	0.421	0.432
31-Nonmetal Mineral Products*	0.045	0.141	0.124	0.145	0.202	0.212	0.453	0.421
32-Smelting and Pressing of Ferrous Metals	0.048	0.134	0.099	0.14	0.211	0.322	0.481	0.481
33-Smelting and Pressing of Nonferrous Metals	0.029	0.1	0.099	0.155	0.296	0.372	0.426	0.474
34-Metal Products*	0.042	0.11	0.129	0.141	0.29	0.333	0.437	0.468
35-Ordinary Machinery	0.036	0.106	0.138	0.15	0.241	0.272	0.45	0.432
36-Special Purposes Equipment	0.041	0.114	0.122	0.144	0.193	0.241	0.41	0.443
37-Transport Equipment	0.037	0.11	0.135	0.142	0.207	0.266	0.441	0.425
39-Other Electronic Equipment	0.048	0.13	0.115	0.152	0.359	0.24	0.443	0.453
40-Electric Equipment and Machinery	0.032	0.124	0.158	0.152	0.338	0.378	0.435	0.427
41-Electronic and Telecommunications	0.038	0.091	0.128	0.159	0.581	0.512	0.438	0.427
42-Instruments and meters	0.056	0.092	0.123	0.162	0.463	0.339	0.456	0.393
43-Other Manufacturing	0.034	0.111	0.147	0.16	0.43	0.451	0.408	0.426

Note 1: This is calculated based on the database used in this paper. The output shares (of private or FIE firms) are relative to the national total output in each two-digit industry and each year.
Note 2: The numbers preceding the industry descriptions refer to the two-digit codes used by the State Statistical Bureau of China.
Note 3: * indicates more labour-intensive industries.
Note 4: In the econometric analysis, the FDI variables are constructed at the more disaggregate three-digit industry level for each of the 31 Chinese regions.
Note 5: Apart from private and FIEs, there are two major categories of ownership in China: State-owned and collective enterprises.

Table 2 reports the output share and exporting intensity of privately owned and foreign-owned firms in the database across the 31 provinces of China. The figures confirm the well-established proposition that the geographic distribution of multinational activity in China is highly uneven, with provinces in the Coastal region receiving the lion share of FDI.

Table 2: Output share and export intensity of PRIVATE and foreign-invested enterprises (FIEs) by provinces

	PRIVATE firms				FIE enterprises			
	Output Share		Export intensity		Output Share		Export intensity	
Coastal region	1999	2002	1999	2002	1999	2002	1999	2002
11- Beijing	0.011	0.037	0.013	0.026	0.441	0.414	0.157	0.153
12- Tianjing*	0.011	0.038	0.177	0.146	0.515	0.532	0.339	0.345
21- Liaonign*	0.054	0.077	0.108	0.094	0.200	0.232	0.468	0.493
31- Shanghai*	0.006	0.052	0.074	0.104	0.546	0.614	0.365	0.341
32- Jiangshu*	0.038	0.177	0.141	0.127	0.268	0.307	0.380	0.362
33- Zhejiang*	0.129	0.279	0.279	0.295	0.189	0.202	0.480	0.545
35- Fujian*	0.035	0.089	0.244	0.225	0.659	0.659	0.521	0.470
37- Shandong*	0.030	0.093	0.097	0.110	0.166	0.167	0.455	0.481
44- Guangdong*	0.039	0.090	0.135	0.165	0.632	0.635	0.601	0.597
46- Hainan*	0.067	0.107	0.000	0.048	0.232	0.236	0.167	0.174
Central region								
13- Hebei *	0.052	0.165	0.054	0.064	0.130	0.133	0.260	0.290
14- Shanxi	0.036	0.177	0.011	0.046	0.052	0.074	0.054	0.155
15- Neimenggu	0.053	0.086	0.022	0.056	0.120	0.108	0.197	0.225
22- Jilin	0.013	0.041	0.009	0.022	0.198	0.265	0.148	0.167
23- Heilongjiang	0.016	0.069	0.006	0.012	0.121	0.114	0.145	0.169
34- Anhui	0.032	0.104	0.108	0.134	0.096	0.169	0.249	0.282
36- Jiangxi	0.018	0.104	0.052	0.059	0.123	0.134	0.156	0.137
41- Henan	0.068	0.111	0.008	0.017	0.074	0.072	0.129	0.154
42- Hubei	0.022	0.102	0.017	0.039	0.118	0.133	0.156	0.152
43- Hunan	0.024	0.108	0.158	0.138	0.030	0.098	0.200	0.170
45- Guangxi *	0.030	0.115	0.194	0.118	0.124	0.215	0.179	0.267
Western region								
50- Chongqin	0.077	0.205	0.028	0.045	0.140	0.158	0.165	0.168
51- Sichuan	0.068	0.141	0.031	0.026	0.081	0.091	0.128	0.145
52- Guizhou	0.027	0.124	0.016	0.018	0.032	0.043	0.078	0.144
53- Yunnan	0.013	0.059	0.058	0.035	0.063	0.068	0.135	0.119
54- Tibet	0.025	0.049	0.000	0.000	0.007	0.004	0.600	0.400
61- Shanxi	0.020	0.040	0.039	0.018	0.148	0.114	0.126	0.133
62- Ganshu	0.012	0.033	0.001	0.002	0.049	0.050	0.072	0.081
63- Qinghai	0.011	0.093	0.059	0.031	0.038	0.045	0.143	0.000
64- Ningxia	0.081	0.119	0.043	0.023	0.113	0.114	0.189	0.176
65- Xinjiang	0.017	0.050	0.000	0.018	0.049	0.032	0.243	0.256

Notes: The statistics are calculations based on the database used in this chapter; The numbers preceding the region names refer to the codes used by the State Statistical Bureau of China; * marks provinces with Special Economic Zones and Open cities.

This chapter mainly focuses on some 28,400 privately owned enterprises that have not received any funds from either foreign channels or state budgets during the sample

period. Thus their main sources of finance are bank loan and self-raised finance. Table 3 provides some summary statistics for the variables used in the analysis. About a fifth of the firms have some exporting experience, and this does not vary much between labour and capital intensive sectors. It is also interesting to note that the average exporting intensity amongst exporters is quite high.

As might be expected, firms in capital-intensive sectors devote more resources to the training and skill upgrading of their employees, while firms in labour intensive sectors employ, on average, 9% more workers than capital intensive ones during the examined period. The firms in the data have registered an impressive average total factor productivity (TFP)[48] growth of more than 10%, consistent with the notion that private enterprises are the main drivers of China's recent economic growth (e.g. Allen et, 2005).

The average bank loan (which is normalised by total assets) is more than 50%. This indicates the appetite that private entrepreneurs in China have for credits. The ratio of self-raised finance to total assets is also quite high.

Table 3: Summary statistics of variables used in the regressions

	All sectors		Labour-intensive sectors		Capital- intensive sectors	
	Mean	Std. dv.	Mean	Std. dv.	Mean	Std. dv.
Export dummy	0.2138	0.4100	0.2202	0.4144	0.2042	0.4031
Export intensity (exporters)	0.6574	0.3581	0.6979	0.3436	0.5921	0.3712
Product innovation /total output	0.0190	0.1138	0.0120	0.0910	0.0294	0.1406
Training expenditure/employment	0.0598	0.3189	0.0456	0.2565	0.0810	0.3933
Size (log employment)	4.6273	0.9386	4.6714	0.9497	4.5611	0.9179
Total factor productivity growth	0.1038	0.7663	0.1012	0.7649	0.1078	0.7683
Age	9.2191	7.7256	8.9452	7.4422	9.6290	8.1145
Bank loans/total assets	0.5135	0.2898	0.5020	0.2929	0.5308	0.2841
Self raised finance/ total assets	0.3017	0.3211	0.3126	0.3538	0.2854	0.2639
Horizontal export-oriented FDI	0.1045	0.1468	0.1181	0.1557	0.0842	0.1297
Horizontal market-seeking FDI	0.1434	0.1336	0.1471	0.1315	0.1379	0.1364
Upstream export-oriented FDI	0.0007	0.0086	0.0006	0.0107	0.0007	0.0036
Upstream market-seeking FDI	0.0009	0.0097	0.0009	0.0120	0.0009	0.0046
Downstream export-oriented FDI	0.0008	0.0047	0.0010	0.0055	0.0003	0.0030
Downstream market-seeking FDI	0.0012	0.0094	0.0016	0.0117	0.0004	0.0041
Observations	40910		24526		16384	

[48] TFP is calculated using the estimator of Levinsohn and Petrin (2003), which accounts for the endogeneity of inputs in the production function estimation. Details see Chapter three Appendix 1.

Table 4 reports the partial correlation coefficients between exporting intensity and the variables used as regressors in the econometric models. I find a positive and statistically significant association between access to bank loans and exporting intensity, and this link is strongest in labour intensive industries. By contrast, the partial correlation between self-raised finance and exporting intensity is statistically insignificant in labour intensive sectors, and negative and significant in capital-intensive sectors. I also identify a strong positive (negative) correlation between horizontal export-oriented (market-seeking) FD and firm level exports. As we shall see, these correlations offer preliminarily an intutition about the links between finance, export and FDI, which are disentagled in the following section.

Table 4: Partial correlation coefficients of exporting propensity with the regressors in the econometric models

	All sectors		Labour-intensive sectors		Capital-intensive sectors	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Product innovation	0.0109	0.027	0.0006	0.929	0.0325	0
Training expenditure	0.0067	0.176	0.0192	0.003	-0.0002	0.983
Size	0.1465	0	0.1349	0	0.1264	0
Productivity growth	0.0037	0.458	0.0061	0.34	-0.0052	0.506
Age	-0.042	0	-0.0177	0.006	-0.0500	0
Bank loans	0.0792	0	0.1170	0	0.0553	0
Self-raised finance	0.0074	0.136	0.0044	0.493	-0.0198	0.011
Horizontal export-oriented FDI	0.2226	0	0.2779	0	0.2425	0
Horizontal market-seeking FDI	-0.1474	0	-0.1268	0	-0.1264	0
Upstream export-oriented FDI	0.001	0.839	0.0131	0.04	-0.0069	0.378
Upstream market-seeking FDI	-0.0067	0.177	-0.0157	0.014	-0.0147	0.061
Downstream export-oriented FDI	0.0153	0.002	0.0238	0	-0.0083	0.29
Downstream market-seeking FDI	0.0533	0	0.0701	0	-0.0077	0.327

Note 1: The partial correlation coefficient of export intensity with each variable listed in the table holding the other variables constant.
Note 2: The p-values report the significance level of each partial correlation coefficient.
Note 3: Partial correlation coefficients assume that the relationship between the variables is linear.

4.6 MAIN FINDINGS AND DISCUSSIONS

The instrumental variables and random effects Tobit models are estimated for the whole sample and for labour intensive and capital-intensive sectors separately[49]. Two reasons for doing this: (i) much of the initial concern regarding export-oriented FDI had to do with labour intensive sectors (e.g. Huang, 2003), and (ii) the two sectors are likely to face different external financing requirements due to their technological differences (cf. Rajan and Zingales, 1998).

The marginal effects from the Tobit models are reported in Table 5. The null hypothesis of exogeneity of regressors is emphatically rejected in all models, vindicating the use of the instrumental variables estimator. In line with existing empirical evidence, both firm size and productivity growth are found to exert a positive and economically significant impact on the propensity to export. For example, according to the IV Tobit model, a 10% increase in firm size is associated with a 3% increase in the share of exports for the average firm. Product innovation is also found to have positive effects on exporting. It is worth noting that the exporting impact of product innovation is more pronounced in capital intensive sectors, where the deployment of new product processes is arguably more crucial to compete in international markets. By contrast, the export market effect of employee training is more important in labour intensive industries, suggesting that skill upgrading is particularly important in traditional industries in order to engage in international commerce.

[49] Labour-intensive industries are indicated in Table 1.

Table 5: Access to bank loans, exports and FDI spillovers

Dependent variable: Exporting Intensity	IV TOBIT			Random effects TOBIT		
Variables	All sectors	Labour-intensive	Capital-Intensive	All sectors	Labour-intensive	Capital-Intensive
Product innovation	0.268	0.209	0.231	0.238	0.259	0.217
	(0.106)**	(0.209)	(0.139)*	(0.034)***	(0.059)***	(0.040)***
Training expenditure	0.144	0.481	0.073	0.028	0.090	-0.002
	(0.048)***	(0.086)***	(0.074)	(0.012)**	(0.025)***	(0.014)
Size	0.300	0.233	0.361	0.165	0.160	0.170
	(0.013)***	(0.025)***	(0.022)***	(0.005)***	(0.007)***	(0.008)***
Productivity growth	0.086	0.079	0.103	0.016	0.020	0.011
	(0.024)***	(0.026)***	(0.039)***	(0.005)***	(0.007)***	(0.008)
Age	-0.005	-0.000	-0.010	-0.002	0.001	-0.005
	(0.001)***	(0.002)	(0.001)***	(0.001)***	(0.001)	(0.001)***
Bank loans	0.787	0.956	0.406	0.234	0.331	0.122
	(0.110)***	(0.106)***	(0.103)***	(0.026)***	(0.038)***	(0.035)***
Self-raised finance	0.162	0.251	-0.076	-0.001	0.015	-0.068
	(0.075)**	(0.071)***	(0.202)	(0.013)	(0.015)	(0.030)**
HE FDI	0.818	0.534	0.910	0.457	0.492	0.479
	(0.321)**	(0.235)**	(0.340)***	(0.064)***	(0.085)***	(0.102)***
HE FDI * bank loans	0.410	1.386	-0.087	0.281	0.323	0.082
	(0.629)	(0.437)***	(0.616)	(0.097)***	(0.133)**	(0.149)
HM FDI	-1.254	-1.446	-1.103	-0.784	-0.937	-0.742
	(0.277)***	(0.376)***	(0.482)**	(0.085)***	(0.121)***	(0.122)***
HM FDI * bank loans	-1.614	-2.193	-1.072	-0.436	-0.740	-0.017
	(0.532)***	(0.778)***	(0.895)	(0.142)***	(0.202)***	(0.204)
UE FDI	1.924	-11.769	7.238	0.759	-4.581	3.504
	(7.916)	(14.037)	(13.496)	(3.813)	(7.176)	(4.648)
UE FDI * bank loans	-5.720	13.061	-13.777	-3.808	2.916	-5.686
	(15.514)	(20.922)	(23.228)	(6.463)	(11.494)	(8.058)
UM FDI	-3.808	6.645	-5.365	-1.709	2.207	-2.773
	(6.972)	(10.510)	(8.763)	(3.395)	(6.459)	(4.113)
UM FDI * bank loans	3.551	-12.121	9.981	2.411	-3.140	4.606
	(13.817)	(16.950)	(16.826)	(5.861)	(10.417)	(7.494)
DE FDI	-0.143	5.766	-20.921	0.514	3.225	-8.006
	(2.542)	(3.965)	(16.419)	(1.705)	(1.911)*	(4.777)*
DE FDI * bank loans	16.662	13.977	19.862	7.704	6.594	8.723
	(4.927)***	(7.164)*	(23.099)	(2.662)***	(2.879)**	(7.816)
DM FDI	-4.035	-2.994	-23.380	-1.880	-1.383	-12.454
	(2.227)*	(1.830)	(10.603)**	(1.017)*	(1.087)	(6.131)**
DM FDI * bank loans	4.361	3.059	27.223	2.327	1.551	15.701
	(2.774)	(2.131)	(11.920)**	(1.333)*	(1.420)	(7.765)**
Observations	40898	24519	16379	40910	24526	16384
Number of firms				28400	17155	11407
Exogeneity test; $\chi^2_{(10)}$ (p-value)	73.18 (0.000)	99.43 (0.000)	171.54 (0.000)			

Note 1: Horizontal export-oriented (HE), horizontal market-oriented (HM), upstream export-oriented (UE), upstream market-oriented (UM), downstream export-oriented (DE), downstream market-oriented (DM) FDI are defined in the text 4.5 Data description.
Note 2: Asymptotic standard errors in parentheses.
Note 3: * significant at 10%; ** significant at 5%; *** significant at 1%
Note 4: All specifications include time, regional and industry dummies.

4.6.1 Access to finance, FDI and exports

The estimates indicate that access to formal financial channels (i.e. bank loans) enhances the exporting intensity of private firms in China, with this effect being more pronounced in labour-intensive industries. By contrast the exporting impact of self-raised finance is insignificant in capital-intensive industries. It seems that the export of capital-intensive

firms in China are dependent on access to external financing and cannot be financed through self-raised cash flows alone. This is an interesting finding in view of Rajan and Zingales (1998) that find a firm's dependence (for its investment) on external finance is a function of its technological characteristics.

I find that export spillovers from FDI in China exhibit substantial heterogeneity. Firstly, export-oriented horizontal FDI has a robust export enhancing effect, consistent with the belief that exporting multinationals transmit information about the international markets to their local counterparts. Secondly, this positive externality from export-oriented FDI is more marked for firms with more access to bank loan operating in labour-intensive industries. Thus access to finance not only has an unconditional impact on exporting, but also helps domestic firms to take advantage of the externalities generated by exporting multinationals in their sector. Thirdly, market seeking horizontal FDI has a deleterious effect on the export market orientation of domestic firms. This effect is more pronounced amongst firms in labour intensive industries with access to bank loans. One interpretation of this result would be that domestic enterprises in labour intensive industries need to borrow more in order to invest, which protects their domestic market shares when facing competitive pressure released by market seeking multinationals. Fourthly, export-oriented FDI in downstream sectors does not have a sizeable impact on the export of domestic firms. This would appear to suggest that exporting multinationals in China do not substantially source locally – or at least their interaction with their domestic intermediate input suppliers does not generate significant exporting opportunities for the latter. Fifthly, market-seeking FDI in downstream sectors leads to a decrease in domestic firms' exporting intensity. It seems that indigenous enterprises supplying intermediate inputs to domestically oriented multinationals tend to be more domestically-oriented themselves, other things constant. Finally, I find no significant relationship between domestic exports and FDI in upstream sectors, irrespective of the market orientation of multinationals.

4.6.2 Are private firms with political affiliation different?

Many privately owned enterprises in China are affiliated at some level to government administration. Such privately owned firms with political connections are colloquially known as "red-hat" firms (Huang, 2004). The function of the relevant government body is to offer credit guarantees and political protection to the affiliated private firms, in return for some "management fees" [50].

I conjecture that politically affiliated firms face "softer" budget constraints, since they are likely to be bailed out by the relevant state body should they default on their loans. An interesting question in this respect is whether politically unaffiliated or "purely" private firms make more efficient use of external finance compared to their "red-hat" counterparts. To explore this issue, I divide the firms in my sample into "purely" private and "red-hats", and estimate the exporting intensity equation on each sub-sample. The results, reported in Tables 6 and 7, indicate that "purely" private firms utilise bank loan more efficiently, as far as export-promoting is concerned. Interestingly, the export-promoting effect of bank loans is insignificant for "red-hat" firms in capital-intensive industries. While it is well documented that the Chinese financial system channels substantial resources towards inefficient state-owned enterprises (Allen et al, 2005 and Boyreau-Debray and Wei, 2005), my finding also provides preliminary evidence that resource misallocation by the banking sector induced by political bias exists even when the analysis is confined to the private sector.

[50] Of course bureaucratic/political affiliation may also have its downside, as "red-hat" firms are likely to encounter some managerial interference from state bureaucrats.

Table 6: Bank loans and exports spillovers from FDI: "purely" private enterprises

Dependent variable: Exporting Intensity	IV TOBIT			Random effects TOBIT		
Variables	All sectors	Labour-intensive	Capital-Intensive	All sectors	Labour-intensive	Capital-Intensive
Product innovation	0.334	0.319	0.264	0.260	0.315	0.235
	(0.188)*	(0.288)	(0.159)*	(0.041)***	(0.074)***	(0.049)***
Training expenditure	0.158	0.352	0.105	0.011	0.064	-0.012
	(0.060)***	(0.112)***	(0.138)	(0.012)	(0.028)**	(0.016)
Size	0.250	0.181	0.325	0.151	0.148	0.158
	(0.020)***	(0.021)***	(0.021)***	(0.006)***	(0.008)***	(0.010)***
Productivity growth	0.049	0.016	0.099	0.009	0.005	0.014
	(0.032)	(0.044)	(0.041)**	(0.007)	(0.009)	(0.010)
Age	-0.008	-0.003	-0.013	-0.003	-0.000	-0.006
	(0.001)***	(0.002)	(0.002)***	(0.001)***	(0.001)	(0.001)***
Bank loans	0.911	1.039	0.485	0.359	0.408	0.261
	(0.121)***	(0.138)***	(0.138)***	(0.035)***	(0.047)***	(0.052)***
Self-raised finance	0.192	0.365	-0.085	0.002	0.021	-0.061
	(0.123)	(0.109)***	(0.161)	(0.017)	(0.018)	(0.038)
HE FDI	1.459	0.935	1.472	0.757	0.758	0.759
	(0.439)***	(0.367)**	(0.401)***	(0.082)***	(0.106)***	(0.129)***
HE FDI * bank loans	-0.185	1.421	-0.739	-0.085	0.098	-0.298
	(0.828)	(0.576)**	(0.728)	(0.125)	(0.169)	(0.182)
HM FDI	-1.463	-1.648	-1.432	-0.651	-0.807	-0.703
	(0.373)***	(0.621)***	(0.500)***	(0.105)***	(0.148)***	(0.155)***
HM FDI * bank loans	-1.335	-2.062	-0.479	-0.651	-1.002	-0.083
	(0.721)*	(1.196)*	(0.775)	(0.179)***	(0.251)***	(0.261)
UE FDI	10.499	-17.616	26.178	-0.342	-12.527	9.905
	(11.526)	(23.272)	(16.446)	(5.767)	(9.459)	(7.835)
UE FDI * bank loans	-16.049	24.418	-44.304	-2.190	14.762	-16.731
	(19.615)	(28.031)	(33.409)	(9.415)	(15.005)	(13.054)
UM FDI	-10.950	8.960	-20.320	0.026	9.105	-6.268
	(10.033)	(16.595)	(24.543)	(5.398)	(8.475)	(8.376)
UM FDI * bank loans	7.422	-21.260	25.542	-3.384	-15.439	5.845
	(16.469)	(22.431)	(42.073)	(9.322)	(14.019)	(14.410)
DE FDI	-0.374	2.871	-21.201	-1.103	0.379	-9.456
	(2.972)	(3.411)	(16.879)	(2.217)	(2.490)	(5.919)
DE FDI * bank loans	15.696	18.197	21.256	9.841	11.464	10.962
	(6.277)**	(6.553)***	(22.272)	(3.545)***	(4.105)***	(9.088)
DM FDI	0.763	1.601	-7.907	1.602	1.806	-0.964
	(2.995)	(4.480)	(11.927)	(1.604)	(1.769)	(6.580)
DM FDI * bank loans	-1.133	-2.349	6.536	-1.717	-1.935	-0.058
	(3.627)	(6.021)	(19.530)	(2.076)	(2.287)	(8.992)
Observations	22626	13559	9067	22631	13561	9070
Number of firms				17276	10428	6924
Exogeneity test: $\chi^2_{(10)}$ (p-value)	124.35 (0.000)	105.58 (0.000)	460.70 (0.000)	-	-	-

Note 1: Horizontal export-oriented (HE), horizontal market-oriented (HM), upstream export-oriented (UE), upstream market-oriented (UM), downstream export-oriented (DE), downstream market-oriented (DM) FDI are defined in the text 4.5 Data description.
Note 2: Asymptotic standard errors in parentheses.
Note 3: * significant at 10%; ** significant at 5%; *** significant at 1%
Note 4: All specifications include time, regional and industry dummies.

Table 7: Bank loans and exports spillovers from FDI: "Red hat" enterprises

	IV TOBIT			Random effects TOBIT		
	All sectors	Labour-intensive	Capital-Intensive	All sectors	Labour-intensive	Capital-Intensive
Product innovation	0.262	0.290	0.210	0.199	0.230	0.170
	(0.147)*	(0.330)	(0.261)	(0.057)***	(0.095)**	(0.067)**
Training expenditure	0.049	0.546	-0.045	0.037	0.175	-0.008
	(0.056)	(0.250)**	(0.058)	(0.028)	(0.056)***	(0.033)
Size	0.379	0.324	0.433	0.186	0.189	0.183
	(0.029)***	(0.042)***	(0.036)***	(0.009)***	(0.013)***	(0.013)***
Productivity growth	0.082	0.105	0.062	0.024	0.037	0.009
	(0.042)*	(0.051)**	(0.032)*	(0.009)***	(0.013)***	(0.012)
Age	0.000	0.005	-0.005	0.001	0.004	-0.001
	(0.001)	(0.002)**	(0.002)**	(0.001)	(0.001)***	(0.001)
Bank loans	0.634	0.852	0.401	0.104	0.229	0.023
	(0.163)***	(0.184)***	(0.361)	(0.039)***	(0.063)***	(0.049)
Self-raised finance	0.190	0.213	0.276	-0.012	-0.007	-0.031
	(0.140)	(0.189)	(0.527)	(0.026)	(0.032)	(0.048)
HE FDI	-0.239	-0.044	-0.501	0.025	-0.007	0.091
	(0.408)	(0.476)	(0.469)	(0.112)	(0.151)	(0.177)
HE FDI * bank loans	1.621	1.342	2.257	0.729	0.729	0.683
	(0.649)**	(0.853)	(0.783)***	(0.170)***	(0.230)***	(0.285)**
HM FDI	-0.905	-1.372	-0.388	-0.873	-0.974	-0.647
	(0.442)**	(0.618)**	(0.517)	(0.141)***	(0.203)***	(0.192)***
HM FDI * bank loans	-1.794	-1.731	-2.067	-0.081	-0.397	0.025
	(0.972)*	(1.152)	(1.194)*	(0.226)	(0.328)	(0.313)
UE FDI	-1.298	0.446	-8.677	1.499	3.017	-1.916
	(9.182)	(20.834)	(26.696)	(5.259)	(11.303)	(6.663)
UE FDI * bank loans	0.247	-3.997	19.789	-3.466	-7.123	9.192
	(18.177)	(37.231)	(29.849)	(9.051)	(17.366)	(11.314)
UM FDI	-2.219	-3.566	-1.803	-2.891	-4.556	-2.251
	(8.275)	(17.191)	(15.267)	(4.533)	(10.251)	(4.870)
UM FDI * bank loans	2.181	3.661	5.045	4.168	6.738	3.011
	(16.390)	(32.803)	(15.986)	(7.974)	(15.600)	(8.809)
DE FDI	1.290	9.107	3.508	2.456	6.342	2.123
	(5.443)	(6.257)	(29.949)	(2.739)	(3.460)*	(7.850)
DE FDI * bank loans	14.326	8.712	-74.973	4.974	2.409	-26.242
	(9.921)	(10.432)	(48.847)	(4.166)	(4.892)	(21.067)
DM FDI	-7.017	-5.355	-83.041	-3.499	-2.850	-41.130
	(3.210)**	(2.963)*	(31.737)***	(1.484)**	(1.601)*	(14.791)***
DM FDI * bank loans	8.615	6.638	98.532	4.858	3.699	50.416
	(4.453)*	(3.454)*	(40.226)**	(1.973)**	(2.118)*	(17.269)***
Observations	18272	10960	7312	18279	10965	7314
Number of firms				11124	6727	4483
Exogeneity test: χ^2_{10} (p-value)	254.30	58.92	108.04			
	(0.000)	(0.000)	(0.000)			

Note 1: Horizontal export-oriented (HE), horizontal market-oriented (HM), upstream export-oriented (UE), upstream market-oriented (UM), downstream export-oriented (DE), downstream market-oriented (DM) FDI are defined in the text 4.5 Data description. Red hat firms are defined by a dummy variable according to the level of government with which firms are affiliated. More specific, red hats are those firms under central government and provincial governments.
Note 2: Asymptotic standard errors in parentheses.
Note 3: * significant at 10%; ** significant at 5%; *** significant at 1%
Note 4: All specifications include time, regional and industry dummies.

4.6.3 Policy implications

Until the late 1990s, private enterprises in China were allowed only to export through state-owned trading corporations. Even then, they did not have the right to retain foreign exchange earnings from their exports in a bank account. While this type of blatant discrimination no longer prevails, private firms still suffer from financial repression, especially those without political connections.

In emerging nations like China, the benefit of exporting is immense: it is a channel of international technology transfer (Kraay, 1999); it creates jobs and generates vital foreign exchange, and hence facilitates the import of technology. My findings that more finance generally means more exports, whereas more FDI (especially market-oriented FDI) can mean fewer export, has an important policy implication: To foster exports of domestic firms, restructuring the financial system in such a way that efficient resource allocation prevails is a more potent policy option than relying only on FDI spillovers. This is even more relevant now that the scope for ensuring the flow of the "right kind" of FDI which generates exports spillovers is now rather limited, since placing performance requirements on foreign investors is against the rules of the WTO, which China joined in 2001.

4.7 CONCLUSIONS

Using a rich panel data set comprising more than 28,000 privately owned enterprises in China, this chapter provides a systematic analysis of the relationship between access to finance, FDI and the export of domestic firms. Controlling for the endogeneity and heterogeneity of finance and FDI, I find that access to bank loan is associated with greater export market orientation, especially amongst politically unaffiliated firms in labour-intensive industries. Export-oriented horizontal FDI is also found to have a robust export enhancing effect, and this positive externality is larger for firms which enjoy better access to finance. By contrast, domestic market seeking horizontal FDI has

a deleterious effect on the export market orientation of indigenous firms, and robust positive export spillovers through vertical linkages with multinationals are rather rare. These findings suggest that rather than just relying on FDI to generate export spillovers, the elimination of financial discrimination against private firms is a more effective way of boosting the exports of indigenous enterprises. The present chapter has the broad implication that the expansion of exports is an important reason why China should undertake the reform of its state-dominated banking system.

CHAPTER FIVE: CONCLUSIONS

5.1 SUMMARY OF FINDINGS AND POLICY IMPLICATIONS

This thesis seeks to gain a deeper understanding of China's current financial system and its role of fostering firm growth. Three aspects that focus on the efficiency of the Chinese financial system from different angles are investigated. The first aspect focuses on the suppliers of financial resources (i.e. banks) and examines the cost efficiency of the Chinese banking industry. The second aspect considers the recipients of finance, specifically, manufacturing firms, and explores the extent to which financial resources have been used to promote firm growth. The third aspect concentrates on a particular growth channel, i.e. exporting, and investigates the interaction between access to domestic finance, foreign direct investment and the exports of private enterprises.

The empirical finding confirms that the overall banking performance has been disappointing. State-owned commercial banks fail to exhibit either scale economies or scope economies, while the joint stock commercial banks only enjoy scale economies. Furthermore, the study establishes that the strength of the joint stock commercial banks may lie more in their superior cost efficiency compared to state banks rather than technical capacity.

Two main policy implications emerge from this investigation. First, more support should be given for the ongoing banking reforms of reducing redundant labour and improving efficiencies, as well as the expansion of service and product scope. Second, the fact that privatisation alone is unlikely to foster the technical efficiency of the domestic banking industry will become even more relevant in the process of state-owned commercial banks' being publicly listed.

The second investigation of the link between capital structure and firm growth reveals that the source of finance matters for firms' growth performance. At an aggregate level, there is a discernible pecking order of how efficiently different

financing channels drive firm growth: this runs in a decreasing order of importance, from foreign finance, to self-raised finance, to domestic bank loans and finally to state budgets. The analysis also shows considerable heterogeneity across firms with different ownership structure, different size and location. Foreign investment is the most efficient financing channel for SOEs' growth, while bank loans and state finance are least effective. Interestingly, self-raised finance is found to exhibit remarkably robust growth-enhancing effect, offering some evidence of the existence of an efficient informal financial channel mechanism in China.

These findings have two policy implications. First, financial reforms are called for to enhance the efficiency of state-owned banks in intermediating saving and directing it to more productive use. After all, with a national savings rate of approximately 40%, a healthy current account surplus and ample reserves, it is not as if there is a lack of funds in China. Second, the development of a broader financial system deserves more attention. An efficient informal financial mechanism not only provides an alternative vehicle for savings and firms' financing (especially those in non-state sector and smaller firms) but can also serve as a catalyst for banking reforms by exposing state banks to market competition.

The third study contained in this thesis has also generated a number of interesting results. For example, access to bank loans is associated with greater export markets orientation, especially amongst politically unaffiliated firms in labour-intensive industries. Export-oriented horizontal FDI has a robust export enhancing effect, and this positive externality is more pronounced amongst firms with more finance, while domestic market-seeking horizontal FDI has a deleterious effect on the export market orientation of indigenous firms.

The main policy implication is that rather than just relying on FDI to generate export spillovers, the elimination of financial discrimination against private firms is a more effective way of boosting the exports of indigenous enterprises.

5.2 LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

As for future research, there are a number of extensions to my thesis that could be considered. Chapter two presented an analysis of the banking efficiency in China based on consolidated bank accounts, while many banks involved have branches in all regions. In this sense, the aggregate bank level data may mask substantial regional heterogeneity in performance. It would be interesting to explore the extent of intra-bank performance differentials, and examine if banking efficiency is systematically related to the degree of regional development and liberalisation should such data become available. This would help design more targeted policies aimed at enhancing the efficiency of the financial sector.

Another potentially fruitful exercise would be to involve city commercial banks into the investigation. Following its WTO entry, China has stepped up the reform of city commercial banks while transforming the four leading state-owned commercial banks. A host of favourable policies like cross-regional operation, stock enlargement and reorganization for public listing have paved the way for the development of city commercial banks. This is expected to enhance the role of city commercial banks in the economy in the foreseeable future.

There are also a number of potentially fruitful research topics that helps understand better how finance affects the overall economy from a micro level perspective. First, the channels through which access to finance affects firms' behaviour should be further explored. For example, China's State Council has recently issued incentive policies[51] encouraging scientific and technological innovation. Thus, it is

[51] The target of the incentive policies is to create friendly environment for carrying out the National Guidelines for Medium- and Long-term Plans for Science and Technology Development from 2006 to 2020. The incentives include promised increase of research and development expenditures, favourable taxation policies towards innovation-oriented enterprises, financial supports and governmental procurement. In addition, specific policies will also be worked out for licensing of alien technologies, intellectual property protection, human resources, improvement of public science awareness and favourable policies for state key research

crucial to investigate how financial constraints affect firms' innovation decision.

Secondly, although Chapter three has provided some insights regarding firm size, finance and growth. More research is required in this area of the literature that is currently based on cross-country studies. It is of particular importance for China, due to the fact that small- and medium-sized firms have an important role in exporting, taxation and innovation in the economy and they suffer from insufficient access to capital.

Finally, China's service industry has been fast expanding since its partial liberalisation, and its added value grew by 10 percent annually over the past 25 years (see China Statistic Yearbook). Hence, it would be interesting to analyse the performance, such as employment growth, of the service sector. This is all the more important since the service sector is expected to provide a solution to the serious unemployment problem faced by the Chinese economy[52].

To conclude, this study has attempted to examine China's current financial system and the nexus between access to finance and firm growth. The results and policy implications of this research have made valuable contributions, as well as offered the impetus for further micro level research aiming at broadening and deepening our understanding of the various issues related to finance and growth, especially for developing and emerging economies like China.

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labs.

[52] For example, see the Chinese Vice-premier Wen JiaBao speech on The People's Daily on Saturday, April 06, 2002.

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