# LUND UNIVERSITY
## School of Economics and Management

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# State-owned enterprises' operating efficiencies does percentage of private share matter?

## Xiazhe Huang

### gic12xhu@student.lu.se

Abstract: What kind of influence does percentage of private share have on state-owned enterprises' operating efficiencies? The thesis studies on the correlation between percentage of private share and SOEs' operating efficiency in China. By analyzing both input and output side of SOEs' performance (i) theoretically, based on previous studies, and (ii) empirically, through data bivariate analyses and variables returns. Due to the limitation on time and data, the thesis focuses on the dataset of Chinese SOEs in National Bureau Statistics investment climate survey in the year 2004. This study aim to dig into the dynamics that how private share percentage in SOE affect its operating efficiency. Then give a discussion about should the central government continue to keep the largest and most important SOEs under control or should we go on with increasing SOEs' private share percentage.

*Keywords*: China, SOE, Operating efficiency, Private share percentage, Privatization

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## 1. Introduction

### 1.1 Overview of Chinese economic transition and SOEs' reforming

In the 1980s, Deng Xiaoping gave the slogan for the Chinese development strategy which was crossing the river by groping for the stones. Since then China opened its door to foreign trade and investment. One of the first step for reforms was reduction of land collectivization introducing the principle of household responsibility in agriculture. The second step was increasing the role of local government and communities. The third was making experiments of market reforms in a few selected special economic zones (SEZs). China's transition to some degree can be track down precisely by the process of SOE reform. There are four phases: fiscal decentralization and expanding SOE autonomy, then issued dual track system and contract responsibility system, after that market economy and corporatization took place, and finally privatization. During the first ten years of reforms to 1988, per capita income in China doubled. After that, due to 1989's inflationary and political crisis, the central government of China implemented a severe program intended to constraint inflation and to reinforce the economy's industrial structure. Since the 1990s, China is included in the intimation division of labor within East Asia at the same time as ASEAN-4. This was also a consequence of the economic re-adjustment in Asian NIEs. China had some characteristics from both South Korea and Malaysia in economic transformation such as open-door and liberalization policies underpinned by export-oriented FDI. But because of the differences in initial conditions and historical legacies between China other East Asian Miracle economies, the path of development was different. Comparing with South Korea and Malaysia, the stated owned enterprises still have the major share of the economy; export oriented policies were mainly restricted to particular area especially eastern coastal cities; the untapped financial market has been keeping transnational finance capital flowing freely; tremendous FDI was brought by small and medium size capital of overseas Chinese; created quasi-private rural industry in TVEs supported the growth of labor intensive industries. With the transition went on, the role of state-owned industrial enterprises

in China has been persistently upgrading. (Xiazhe 2012) At the year of 1980, SOEs played as the central role of China's industrial sector, accounting about 57% of industrial employment and 76% of gross industrial output (China Statistical Yearbook 1999, Chapter 5). In 1978, the state-owned enterprises share 77% of total industrial output, however only 49.6% till 1998. The gains of industrial state-owned enterprises were 15% of GDP in 1978 and only left less than 2% of GDP till 1997. By 2004, only a few of SOEs remained in the original form and still some 38% of industrial production was being made by companies which were classified as state-owned and with corporations of the majority of whose shares were had by central government and local governments. It seems that more state-own enterprises will have other types of shares in their board including private shares. (Li, Weiye and Putterman, 2008)

The sources of China's growth are partially reflected in the ownership sectors where investment is occurring. Till the 1990s, Chinese economy has been transformed into an economy which has dual structure. However, the concept of private sector was not clear during that time. In Chinese official statistics, all non-SOEs are belong to the so called private sector. It contains enterprises which are certainly government owned in fact. Others are sole proprietorships, private enterprises and foreign-owned enterprises. Some scholars describes the private sector as the "fundamental driving force in China's economic growth…in maintaining economic and social stability; as a source of technological innovation; in resisting recession and accelerating economic recovery after the Asian financial crisis; in re-employment of urban laid-off workers, and in relief for rural poverty and farmers' incomes." (Wu 2006) These sectors which composed of FIEs and private enterprises played a major role of Chinese economic transformation. At the same time, the state sector focused on heavy industry and created a high percentage of gross domestic fixed capital formation, gross output value and the number of employees. In 1995, the Fifth Plenum of the Fourteenth Central Committee of the CCP implemented the policy of "grasp the large and release the small". As a consequence, government selected the medium and large-scale high-technology industry and the security-related sector from SOEs as strategic sectors. However, according to the comparative advantage theorists the State Development and Planning Commission suggested that the state should pay more attention on developing firms with intermediate-level technology. In order to reinforce

the dominance of large-sized SOEs have the capacity to compete in the world market, the industrial re-adjustment policy was created to promote strategic industries with intermediate-level technology.

This new movement led to joblessness of millions normal workers in SOEs, urban collective companies, and even government offices and public service units. Such huge shock began in 1995, and last four years after that from 1996 to 1999 with an average of seven million employees drop annually. (Dong and Xu, 2009) Based on a historical panel survey of 683 enterprises in 11 cities, till the end of 2001, 86% of all state-owned enterprises had gone through the new restructuring process called "gaizhi" (changing system), which had various forms, including public listing of shares and corporatization, internal restructuring, sale shares, joint ventures, and bankruptcy. 27% of mid-size and large-scale SOEs applied employee shareholding, 28% of them were leased out or sold to private owners, 20% went through restructuring within firms' itself, 8% began with ownership diversification including private placement or public offerings to outside investors, 4% became joint ventures, and the rest 13% of SOEs had been through debt-equity swaps or bankruptcy in this survey. About more than 70% of these cases, "gaizhi" included the transfer of at least a portion of ownership from the nation to private hands. Nevertheless the released small state-owned enterprises and the large scale of laid off workers from SOEs, the state still to be the biggest shareholder in firms accounting for 21% and state-owned enterprises continued to account for 11% of China's industrial output in 2004. (Garnaut *et al.*, 2005, pp. 50–51)

## 1.2 Current state of SOEs

According to OECD Working Group on Privatization and Corporate Governance of State Owned Assets, a narrow definition of SOEs which "state-owned enterprises" refers to business entities established by central and local governments, and whose supervisory agencies are from the government had been used in official statistics during prior-reform period. This definition only includes wholly state-funded companies, therefore it has some statistical limitations. The current definition of SOEs which includes state-owned and state-holding enterprises has been

used since 1995. State-owned and state-holding enterprises refer to state-owned enterprises and also state-holding enterprises, where state-owned enterprises are above-mentioned completely state-funded companies and the conception of "state-holding enterprises" is which that they are some firms whose majority shares belong to the government meanwhile they also involves other types of share, for instance private share. The new definition of SOEs is primarily used in the following statistics on industrial enterprises, as published in the China Statistical Yearbook and so on. Since the mid-1990s, data sources from China include all state-owned and state-holding companies which also reflects privatization reform. (OECD, 2009)

In order to have a better understanding about current state of this broad definition of SOEs, several tables and figures have been shown below. From the perspective of the relative employed workers size and assets scale, industrial SOEs are comparatively larger than private and foreign counterparts. When it comes to the per capita asset size, SOEs tend to be stay in more capital intensive area. Plus, after 1998 SOEs has developed significantly toward the higher capital intensity. According to this table, despite of profitability which calculated by ROA index has been weaker than private firms and foreign companies, SOEs' performance has become better and better. In another word SOEs' ROA has risen from 0.7% in 1998 to 6.3% in 2006. Based on the movement of SOEs' per capita value added, in 1998 SOEs' was only 29555.9 (yuan) while in 2006 was 180647.5 (yuan) which shows that the corporate performance of SOEs has obviously increased in a relatively high speed compare to private and foreign firms during these 9 years (see table 1).

Table 1. Performances of Industrial SOEs, 1998-2006

| Industrial State-Owned Enterprises | | | | | | |
|---|---|---|---|---|---|---|
| Year | Average Asset size (million yuan) | Average number of employees | ROA (%) | Asset Liability Ratio (%) | Per Capita Value added (yuan) | Per Capita Asset (yuan) |
| 1998 | 115.7 | 578.9 | 0.7 | 47.6 | 29,555.9 | 199,895.1 |
| 2002 | 216.6 | 589.3 | 3.0 | 59.3 | 65,748.6 | 367,608.1 |

| 2006 | 541.5 | 722.7 | 6.3 | 56.2 | 180,647.5 | 749,187.1 |
|---|---|---|---|---|---|---|
| Industrial Foreign Enterprises | | | | | | |
| 1998 | 80.7 | 293.2 | 2.0 | 58.5 | 52,310.7 | 275,119.0 |
| 2002 | 91.4 | 305.9 | 6.0 | 54.4 | 81,312.5 | 298,895.6 |
| 2006 | 126.7 | 348.0 | 7.0 | 56.3 | 120,607.1 | 364,046.3 |
| Industrial Private Enterprises | | | | | | |
| 1998 | 13.9 | 150.7 | 4.5 | 61.2 | 31,693.4 | 92,473.9 |
| 2002 | 17.8 | 149.0 | 5.6 | 59.3 | 44,423.9 | 119,520.0 |
| 2006 | 27.1 | 131.6 | 7.9 | 59.1 | 95,057.2 | 205,553.7 |

Source: China Statistical Yearbook, 2007


Also based on the China Statistical Yearbook's definition of SOE, given table below shows state-owned enterprises' large share scale in the overall Chinese stock market (see table 2). During 1995-2007, SOEs share among total domestic stock market capitalization increased from 73.1% to 83.1% which equals to 10%. The reason of increasing trend of SOEs share in stock capitalization is due to the process of SOEs' reform. Such movement accelerated state-owned enterprises to change their structure into shareholding ones which also have the possibility of increasing percentage of private share within the firm.

Table 2. SOEs' share among total Chinese stock market capitalization

| Year | Volume of market capitalization (100 million yuan) | | SOEs' share (%) |
|---|---|---|---|
| | Overall market | SOEs | |
| 1995 | 3,867 (311) | 2,826 (211) | 73.1 |
| 1999 | 27,974 (923) | 19,421 (626) | 69.4 |
| 2003 | 45,255 (1,266) | 37,108 (928) | 82.0 |
| 2007 | 400,409 | 332,769 | 83.1 |

| | (1,516) | (936) | |
|---|---|---|---|

Source: CSMAR database

Note: All of the A-stock firms in the Chinese stock market are included in above table.

Figures in brackets are the number of enterprises referred.

From a comparative scope to acquaint ourselves with current state of SOEs, we can observe through this figure 1 shown below that Chinese No.1 SOE Sinopec has 10 times operating income than No.1 PE Huawei in 2010. Hence, Huawei as No.1 PE only ranks No.39 among China's top 500 enterprises. That means beyond Huawei, there are still 38 companies had greater operating income, among them state-owned enterprises are the majority. According to this figure, we can obviously see how tremendous are the SOEs by looking at their operating income.

Figure 1. Operating income of Sinopec and Huawei in 2010
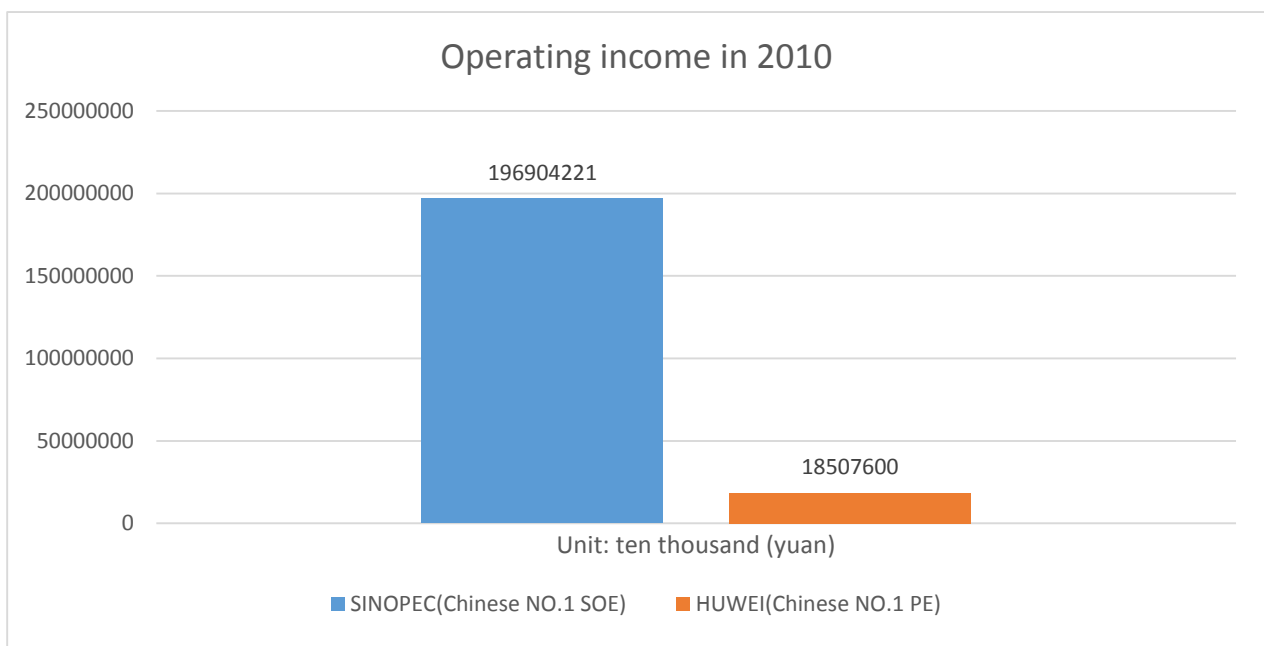


Source: www.CNPolitics.org, 2010; author's calculations

To sum up, Chinese state-owned enterprises still are the back bone of this country's economy. In consideration of such large scale of SOEs with persistent increasing in the corporate performance, share in stock capitalization and so forth, a study on SOEs' operating efficiency can make a significant contribution, as understanding how percentage of private share affect SOEs' performances.

## 1.3 Aim of the study

After series of SOE's reform, it is true that SOEs still remain the most important part of the Chinese economy, particularly among certain strategically main sectors, for instance telecommunications industry, infrastructure construction, natural energy and raw materials, financial services sector and so forth. Therefore, the operating efficiencies of SOEs have remarkable impact on China's economy growth as well as in the global circumstance. What's more, with the reform process moves on, the percentage of private shares and board system take place in more and more state-owned companies. This study aim to dig into the dynamics that how private share percentage in SOE affect its operating efficiency. Then give a discussion about should the central government continue to keep the largest and most important SOEs under control or should we go on with increasing SOEs' private share percentage? Based on Li, Weiye and Putterman's research overview, the certain year 2004 is chosen to address this research question because only a few of SOEs kept in the original form and 38% of industrial production was being created by companies that were classified as state-owned and with corporations of other type ownership of whose shares were had by managers or public while the majority shareholders are central government and local governments. As far as I'm concern, this year is the watershed of SOEs' performances to get much better. Therefore state-owned enterprises' data from National Bureau of Statistics NBS [2004] which including figures of SOEs' private share percentages is used. This dataset was collected in 2004 by National Bureau of Statistics in China which is about an investment climate survey for all kinds of companies. It will focus on the percentage of private shares in state-owned enterprises, due to the method of using micro-data and the limitation of the dataset.

After overviewing the Chinese economic transition and SOEs' reforming and elaborating the current state of SOEs, the structure of the thesis will be presented as follows: section 2 will be research qustion with hypothesis, precisely defining what the thesis engage to find out. Section 3 presents previous literature review with theoretical foundation, section 4 is the empirical method part, in this part first I'll introduce the reason that the dataset is chosen, in what way I'll use it and also the limitation of this dataset. Then it comes to data selected and statistical

description part. After that it will be the model specified for econometric analyses based on research question. Finaly, in section 5 I'll summarize the results and discussions, and draw the conclusion.

## 2. Research Question and Hypothesis

<u>State-owned enterprises' operating efficiencies does percentage of private share matter?</u>

From a broad perspective of companies' level, there are many aspects of indicators with state-owned enterprises can be tested with the degree of privatization's influence on firms' operating efficiency. Notice that this paper does not analyze the whole extent of privatization but one simple aspect which the percentage of private ownership's influence on state-owned enterprises. Such as company's profitability, its operating efficiency and so on. These are the most important indicators which can present a company's performance. This paper only focus on the correlation of operating efficiency and private share percentage in state-owned enterprises.

In order to test the correlation between the operating efficiency of SOEs and private share percentage, this paper brings up some hypotheses. Come to light, when SOEs' managers and employees are faced the improvement of private share percentage, they are subject to a hard budget constraint. In addition, they are pressed to improve operating efficiency so that they can maximize sales proceeds and income. This is due to the social interest is focused on the operating efficiency of SOEs, people who work in this company care more about benefits than the fulfillment of plans or programs given by government, which in turn of hardens the budget constraint. Therefore, no more mistakes are allowed for managers and employees to make. As a consequence SOE's operating efficiency will be deeply accelerated. Based on this mechanism, the expectation is that the growth of private share percentage will have positive impact on the operating efficiency.

However, the measurement of operating efficiency usually include two aspects which are

output side and input side. For the former, this paper used sales per employee as output efficiency. For the latter, it used net income per employee as input efficiency. In a business context, operating efficiency can be defined as the ratio between the input side to run a business operation and also the output side obtained from the business. When operating efficiency is improved, the output to input ratio improves. In order to improve operating efficiency, one has to start by measuring it. As far as I'm concerned, since operating efficiency is about the output to input ratio, it should be measured both on the input and the output side. Therefore, this paper will do a director test by using two indicators, sales efficiency and net income efficiency. In other word my hypotheses have two sides:

H1: growth of private share percentage improves state-owned companies' sale efficiency

H2: growth of private share percentage is conducive to state-owned companies' income efficiency

## 3. Previous researches review and theoretical foundation

When it comes to the discussions of state-owned enterprises' operating efficiency, why countries need SOEs to be their pillar should be initially figured out. There are many factors for keeping state-owned enterprises running. For instance, Friedman and Garner named four reasons which are defensive construction, controlling monopoly industries, ideological predilection from politicians and promotion or acceleration of economic development. (Friedman and Garner 1970) Many scholars also brought about some same ideas to explain the reason of state-owned enterprises' appearance. Those previous studies of SOE's establishment all have a common point which was addressed to public interest rationales. Based on their theory, the establishment SOEs were called of social requirement. With regard to SOEs' inefficient performances, Friedman and Garner used "soft budget constraint" theory to explain. In their opinion, the main reason of inefficiency in state-owned enterprises is because these SOEs rely too much on the government. Their bad loan or non-performing loan can be easily solved by using funding from official agencies, this phenomenon leads to soft budget constrain. Due to

specific target or strategically purpose, government will not to allow a large scale of SOE to shut down. Therefore, the hard budget constraint which private companies suffer by the competitive markets and the worries of financial deficit barely have influences on state-owned enterprises. Plus, if some percentage of private share increase in SOEs, the owners of private share will also suffer from the risk of loss, then these kind of SOEs' budget constraint will be "harden". As a consequence, they will find way to improve company's operating efficiency in order to avoid bankruptcy. Therefrom, I assume percentage of private share has positive impact on SOEs' operating efficiency.

However, along with a huge number of SOEs operating in China, more and more researchers viewed these companies' bad performance critically. In order to improve SOEs' performances, one of the most efficient way is to privatize state-owned enterprises gradually. Some theories support privatization of SOEs, for example property rights theory by Harold Demsetz, agency theory by Jensen and Meckling and public choice by Niskanen. According to Cuervo and Villalonga's summary, the agency theory think that general managers seek to maximize their own profits rather than that of the owners of the company or the company itself. Nonetheless, general managers in private enterprise are constrained by a number of external control mechanisms, such as the market environment for managers, and also by internal control mechanisms, such as rewards incentives and compensation. (Cuervo and Villalonga, 2000) According to property right theory which raised by Harold Demsetz, if a company get more percent of private share, those people who are related to such share will have worries about bad performance of their company. Therefore, they will hardly seek their own advantages but get incentives to maximize profits. (Harold Demsetz 1967) Based on property right theory, I obtained the theoratical foundtion to study the influence of private share percent on state-owned enterprise's operating efficiency. To be more specific, to find out the correlation between state-owned enterprises' private share percent and their operating performances.While in addition to aforementioned property right theory which comes from Harold Demsetz, most criticism focused on the lack of property rights protection. When it comes to public choice theory, it's more about the government network. State-owned enterprises' managers are usually more care about maximizing their own power, their reputations, and the amount of resources under their

control. (Niskanen, 1971) Sonja Opper argued that property right theory is not the single factor of the global movement to privatize state-owned enterprises. She pointed out that the political decisions to privatize and implement the relevant programs are not a consequence of economic efficiency calculations alone. The public choice theory and interest group theories also need to be considered into account. She goes on in explaining that these two approaches are the key role to be with the related stakeholders (interest groups and politicians), which duly accounts for the fact that a change in formal institutions such as property rights is shaped decidedly by societal disputes over the given distribution of resources. (Sonja Opper 2004) Comprehensive the above point of view, inspite of persistent debating between property right theory, public choice theory and agency theory, even interest group theory and so on, all the theories have a common point that privatization has significant influence on SOEs' operating effitiency regardless of whether positive or negative. These theories support the idea which to exam SOEs' private share percentage's impact on SOEs' performance as one aspect of privatization.

Through the last 30 years, many researchers have viewed that state-owned enterprises (SOEs) should be privatized while others have an opposite idea that it should be a more gradual reform approache. At the beginning of this debate, scholars were interested in (governance intervention) ownership structure which they believed was the crucial factor of state-owned enterprises' inefficiency. However, as decades of research went through, both supporters and opponents of privatization have come to notice that the importance of market structure and managerial objectives. Therefore, some argued that it need to pay more attentions to how government could achieve performance-oriented goals and competitive market conditions as well on SOEs's operation. While those who agreed with privatization thought that privatization is the only method to bring about changes in managerial goals and towards competitive environment, others maintained that it can be accomplished by more gradual approaches. Stuck in the controversy, policy makers from government were often left with little policy options but to continue with traditional SOE policies. The situation in China is very similar where a tremendous state-owned enterprises' sector has been criticized for its performance and the government has been hard pressed to find ways to enhance their performances through the economic transition. Therefore, some researchers tried to explain that only obey political goals

is a main incentive for SOEs' general managers and this lead to state-owned enterprises' performance inefficiency.

According to Simeon Djankov and Peter Murrell, "the classical state-owned enterprise by definition was oriented to an input-output plan rather than any market. Achieving the plan was of main importance and the plan was normally very ambitious. Thus, production issues dominated entrepreneurship, marketing, and cost minimization in managerial concerns. As a result, the typical manager was a production engineer and not a businessman. Managers faced a mix of monetary and career-based incentives, which were a function of plan fulfillment, enterprise performance, and political loyalty Profits and efficiency were much less important than they are under capitalism." (Simeon Djankov and Peter Murrell 2002) This thought has its own validity, when a person or a group of people is driven by political goals, their decision will mainly serve for government's targets which might not be the best to get profit for instance as aforementioned managers. Relatively speaking, with the process of SOEs reform, some people who are able to have shares in SOEs will make decisions which are market oriental. In consideration of such idea, when dealing with SOE' operating efficiency whether it has a board of director to some degree can be regarded as a important indicator. With the process of economy reform, I asume that managers and shareholders will become more and more market orinental. As a consequence, whether a SOE has a board of director will have significant influence on its performance.

Since 1979 China started its economic reform, its economy has experienced one of the most spectacular growths in recent decades. Even though property rights protection of private didn't formally exist in China's constitution until March 2004, the majority of China's economic growth has been driven by its private enterprises. Chinese government realized that industries serve for political goals were losing position in the global economy. Economic growth was blocked and living standards were not improving. State-owned enterprises then have been trying to restructure their property arrangement. It is known that Chinese government has used a variety of methods to transform state-owned enterprise. For instance, during the early 1990s, government sold shares of state-owned enterprises through public stock exchanges which were

newly established at that time. Moreover, they sold shares to general managers in the companies. These two methods above led to an increasing of private share percentage in state-owned enterprises. However, many empirical evidences have been found in a vast of literatures which usually focus on two sides. On the one hand, to compare the relative performances of private companies and public firms. On the other hand, to compare the operating efficiency of the state-owned enterprises from pre-privaization time to post-privatization time. For the fommer, Kim Junki drew a conclusion that the operating efficiencies of privately owned companies are generally much better than those of SOEs and partially privatized enterprises (Kim 2007). For the latter, Magginson and Netter's survey confirmed that the increasing in company's profitability (both operating income to total assets and operating income to sales) was significant after these listed companies went through the process of privatization. For instance, they analysis this issue from three perspectives which includes characteristic of nations, region and technique to privatize then they found evidence to supporte the idea that with more degree of privatization public companies are much more efficient and more profitable than otherwise comparable previous state. (Magginson and Netter 2001) According to their result, I asume that the current gradual reform in China has a positive effect on companies with incresed private share percentage especilly for state-owned enterprises. Nevertheless as listed literatures in their survey, a comparation of SOEs' operating efficiencies with different private share percentage is seldom found. If a dataset is used to do such comparation, then maybe I can get a new result which different from above-mentioned two research directions. In other words, I can obtain how percentage of private share affect state-owned enterprises' operating efficiency.

Some scholars tried to use another empirical approach to do research on the influences of state ownership on firm performances by using a multi-industry, cross-national, time-series methodology. For instance, Boardman and Vining examined the operating performance of the 500 largest non-U.S. industrial companies in 1983. They used four profitability ratios with two measures of X-efficiency. Then they drew conclusions which privately owned companies are much more profitable and productive than mixed state-private ownership firms and state-owned ones. The other finding is that SOEs' profitability will be weaken by mixing ownership type (private part increasing). Therefore, they suggested that government should conduct full private

control instead of partial ownership in order to achieve performance improvement. (Boardman and Vining, 1989) The generally same method was used in Dewenter and Malatesta's research by using more recent dataset. Basically, they examined whether the labor force, income ability and debt levels of state-owned enterprises in the 500 largest international firms, which were reported in Fortune separately in 1975,1985 and 1995, differ from privately owned companies in the same samples. In this study, they controlled for firm size, location, industry, and business-cycle effects and again obtained a result that model of private firms is better than state-owned one. (Dewenter and Malatesta, 2000) Although their efforts were put more into private versus state-owned, they provided approaches to study on firm level performances by using cross-section time series data. Furthermore, the significant choice of controlling for firm size, location, industry, and business-cycle effects is very worth considering.

Some scholars tested that how the profits of privatization might change with respect to the types of new, non-state ownership. (Frydman, Gary, Hessel and Rapaczynski 1999) There also exist other types of privatization and restructuring in China, such as share-issuing privatization (Wang, Xu and Zhu 2004), shareholding ownership (Jefferson and Su, 2005) and so forth. Above research all have some common points in micro-level of ownership changing within state-owned enterprises or in Chinese privatization context. They used different dataset and method to test, due to the quality of data source or examining approaches, some of their results are insignificant. Another interesting research was conducted by Bai, Lu and Tao, which is about non-state ownership percentage's influence on SOEs' performance. This study provided an obvious empirical evidence to support increasing in non-state ownership percentage accelerate SOEs' efficiency. In their article they found firstly the logarithm of total assets dropped but the logarithm of sales increased with the extent of privatization, secondly the operating income to sales and operating income to total assets increased with the percentage of non-state ownership and thirdly both operating income per employee and sales per employee increased with the degree of privatization. According to their work, they focused on a sub-sample of 15,496 enterprises which were 100% state-owned in 1998. There were 12,630 of them remained fully state-owned ownership until 2003 and 2,866 of them were privatized to various extent by 2003. (Bai, Lu and Tao 2005) They inspired me with such idea that any

reduction in state ownership is referred to as privatization. In addition, they didn't classify privatization by the types of new capital, which might be private ownership, collective one, HMT ownership, or foreign invested one. Hence, from my study based on the data source of National Bureau of Statistics NBS [2004], I'm able to exam classified private share percentage's influence on state-owned enterprises' operating efficiency. Compare to their study, this thesis focus on more micro-level and accurate aspect.

Similarly, an empirical case study on the performance of state-owned enterprises and the privatizing pressure was conducted by Junki Kim and Hongkyou Chung. In their study, based on budget constraint theory, they tested if the government imposition of hard budget constraint on state-owned enterprises has impact on their operations or not. (J.Kim and H.Chung,2007) Firstly, they compare 22 Koean state-owned enterprises' performance through two periods which are under the privatization pressure and subject to little privatization pressure. Secondly, they used time-series and cross-sectional (TSCS) regression analysis with a dataset from 22 Korean SOEs. The result of this study is that statistically significant positive correlation does existe between the privatization pressure and the operating efficiency of SOEs. However, in their entire research, the dependent variable privatization pressure was design as a dummy variable with 0 stands for the Roh administration (with out privatization pressure) and with 1 stands for the Kim administration (under privatization pressure). In my opinion, the conception of privatization pressure is relatively vague and lack of gragual changing. Due to different policy adjustments,the degree of privatization is a floating indicator. It might be better if one study on precise aspect such as private share percentage's impact on state-owned enterprises' efficiency. Keeping their metod opinion in mind, to control the macroeconomic factors and other firm characteristics, I believe that a cross-section data regression is needed. Not only for controlling characteristics and macroeconomic factors but also to find out variables' causality in the best way. Different from their methodology, in this paper only cross-section dataset is used in order to focus on certain year and also due to data source limitation.

## 4. Empirical Method

### 4.1 Research Design

In order to pursue the aim of the study, this research will be conducted in a quantitative way that based on a series of micro-level dataset analyses by the cross-sectional design. Micro data or survey are individual level data, for instance data about individual people. In a typical survey dataset, each row represents an individual person and each column an attribute such as age, gender or job-type. (http://www.esds.ac.uk/international/elearning/limmd/materials/LIMMD-unit5/glossary.html) When it comes to cross-sectional research design "entails the collection of data on more than one case and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables, which are then examined to detect patterns of association" (Bryman, 2008 pp.44).

The data used in this paper consist of the investment climate surveys for company managers, accountants and HR managers of the company as well as city information from the National Bureau of Statistics in 2004. The dataset is a cross-sectional dataset that covering 12400 companies in 120 cities. In each second level city there are 100 numbers of observations, for the first level cities such as Beijing, Shanghai, Tianjin and Chongqing from which there are 200 observations each. Discussions about dataset will be shown in following chapter. As mentioned before, a cross-section data regression is needed so that I can control characteristics and macroeconomic factors in order to find out the causality between percentage of private share and state-owned enterprises in the best way. Since the dataset is collected from three survey reports in other words information is answered by individual respondents, thus, from a perspective of social science some figures from these survey may accompanied by subjective views to some degree. Therefore, in order to minimize the influence on subjective views when this research is design to deal with objective indicators from these surveys such as firm size, firm age and sector and so forth.

**4.2 Data Selection**

To address this research question, state-owned enterprises' data from National Bureau of Statistics NBS [2004] is used. This dataset was collected in 2005 by National Bureau of Statistics in China which is consist of two investment climate surveys for all kinds of companies' (state-owned, collective, corporation, private, foreign) general managers, accounts and HR managers and city information in 2004. As an agency directly under the State Council's control, the National Bureau of Statistics is in charge of statistics and economic accounting in China. The National Bureau of Statistics of China can public China Monthly Statistics, China Monthly Economic Indicators and China Statistical Yearbook and so forth. These publications present national level, provincial level, city level and even individual level states including economy, society, region and all other aspects of statistical data. The National Bureau Statistics of China provides comprehensive data bases that can reflect both economic and social development current situation for the People's Republic of China every year. (Functions and Organizational Structure of the National Bureau of Statistics, 2007)

By looking at the dataset of the National Bureau Statistics investment climate survey, we can have many data source based on interviewee's answer. In the first part that is about questionnaires for general managers in all kinds of companies in China which generally concludes basic company information for instance major type of activity, investment factors impeding firm growth, relation with both input and output side and so forth. From first survey part, I selected data of do company have a board of director, the year the company established, major type of activity and city the company located from information on general manager and board of directors section. The second part is about questionnaire for accountants and HR managers in the company that consist of ownership information, financial statement and labor statics and so on. In the second survey, I choose data of ownership structure (percentage owned) from ownership and shareholding information section. Meanwhile, I selected data of total sale and income from financial statement section. In addition, I took data of total employment from labor statistics section. The third part is city information collected from the local governments. I encode cities of these companies located by making use of city information data. So far, factors

and indicators that I want to use in this research question are sufficiently supported by these three investment climate surveys and city information dataset from the National Bureau Statistics of China. Therefore, based on data collected from aforementioned NBS survey, both of the hypotheses that are raised in this paper are testable.

**4.3 Data Validity and Limitation**

However, when using dataset for quantitative analysis, it have to be relatively criticized about materials from Chinese questionnaires and data sources. Those questions about whether the Chinese official statistics are reliable or not seems to be a historical debate among researchers.

According to OECD Working Group on Privatization and Corporate Governance of State Owned Assets aforementioned differences between Chinese official definitions of SOEs from pre-privatization period to pro-privatization period are discussed. The narrow definition of SOEs which "state-owned enterprises" refers to business entities established by central and local governments, and whose supervisory agencies are from the government had been used in official statistics during prior-reform period. This definition only includes wholly state-funded companies, therefore data analysis and studies that based on this period should be criticized more due to some conceptual limitations. The current definition of SOEs which includes state-owned and state-holding enterprises has been used since 1995. State-owned and state-holding enterprises refer to state-owned enterprises and also state-holding enterprises, where state-owned enterprises are above-mentioned completely state-funded companies and the conception of "state-holding enterprises" is which that they are some firms whose majority shares belong to the government meanwhile they also involves other types of share, for instance private share. (OECD, 2009) The reason why NBS 2004 is chosen to study SOEs' private share percentage is well supported by this opinion. All the data collected from SOEs in NBS 2004 includes newly defined SOEs. Therefore, the validity of this dataset is insured from the definition aspect.

From the perspective of data selection, all the indicators that are chosen in this research are

objective data, for instance firm age, total firm sale, total firm employment and so forth. In this paper, some general problems that caused by social actions and subjective views in survey data are artificially avoided. Even if the individual respondents answered question face-to-face, the data selection method can make sure the objectivity and validity of this study. When it comes to validity of NBS data source itself, as is stipulated in the Statistical Law, the State establishes a centralized and unified statistical system by instituting the statistical management system featuring unified leadership and decentralized administration. Government statistical agencies and personnel shall exercise their functions of statistical survey, reporting and supervision according to the law without any infringement. The Chinese government also devotes major efforts to publicize the significance of statistical work amongst the public, popularize elementary statistical knowledge and promote the awareness of citizens and legal entities of their obligation to report statistical information as well as their responsibility in case of violation of statistical laws. As a consequence, citizens and legal entities alike show a high degree of support and cooperation in Statistical activities. (Functions and Organizational Structure of the National Bureau of Statistics, 2007)

Here I cite an empirical evidence to state data validity does exist in Chinese official statistics. Gregory C. Chow wrote a paper about lessons from studying the Chinese economy to prove that it is possible to do economic forecasts because of validity of econometric models and parameter stability. With the Chinese official statistics, he successfully made the forecasting of the overheating of the Chinese macro-economy in 2004 and inflation in later years. (Gregory C. Chow, 2009) There are many more evidences showing that Chinese official statistics is reliable.

However, this thesis is defined as the analysis on domestic micro-data instead of group or macro-level data which cross countries. Although the influence of privatization on SOEs' performance as a whole is discussed both practically and theoretically by previous researches, for the variables and figures are still relatively narrow as to study private share percentages' impact on SOEs' operating efficiency. Therefore, the thesis has limitations on both data source and study scope. In other word, my result can only focus on phenomenon explanation rather

than analyze entire institutional reform. The content of research is further narrowed down to the base number of SOEs is comparatively larger than target SOEs (those have private share percentage). The scale of sample size directly relate to the applied range of empirical testing result. That is to say, sometimes the final outcome might be over fitted. Another limitation exists in data available that NBS investment climate survey 2004 is the most recent and fitted dataset for this study which is accessible. What's more, due to cross-section data is used, this study might face the time frame limitation because the survey was conducted in 2004. Generally speaking, this research's assumption is based on several significant theory and data also can be considered as comprehensive and accurate. Though the final result to some degree can only focus on relatively narrow aspect due to the limitations. Or even some results might not be statistically significant due to some low reliability level variables. Nevertheless I believe that the anticipation of this study will generally match soft budget constraint and institutional theory. Despite the limitations of the dataset, I can still expect it to reflect certain correlation between private share percentage and SOEs' operating efficiency. In addition, when we get better understanding of limitations then the results and conclusions of the research can be applied in more valid and fitted field.

**4.4 Data Management**

This paper is interested in estimating effect of private share percentage on operating efficiency of state-owned enterprises. In order to arrive at two previously mentioned hypothesis, the following parts will provide a presentation of the dependent variables, independent variables and control variables followed by the model specification and a description of the variables. At first selection, observations are dropped which thoroughly have no influence on my research and some observations are partially restricted. For instance in register status only SOEs are maintained and other eight ownership types are exclude because this research is focused on state-owned enterprise. In the second step, this paper inspected into those factors which are kept in dataset. Some missing values and wrong coded variables are dropped. Some outliers are excluded for later research. For the main indicator of this research which is the private share

percentage, it is found that only a few SOEs have private share when they are compared with the total number. Therefore those SOEs which do not have private shares are excluded.

*Dependent Variables* Based on the definition of operating efficiency as in most papers about SOE performance, including Magginson et al. (1994), Wei et al. (2003), and Kim (2007), sales efficiency which equals company's real sale in 2004 is used to divide that year's total employment. For input side, income efficiency that equals the core business income in 2004 divide that year's total employment is used as a proxy of total output efficiency giving us income per employee to measure firm profitability (Li 1998; Li and Xia 2008). Both of these dependent variables are continuous variables, missing values and wrong code variables are drooped.

*Independent Variables* When it comes to independent, or explanatory variable, private share percentage as the percentage of private ownership in state-owned enterprises' ownership structure part is picked as independent measurement. Our independent variable is also a continuous variable. Those SOEs don't have private share percentage are dropped, in other words, if the value of private share percentage equals 0 will be dropped. Because when we look into SOEs' privatization in a Chinese context, it is still an on-going case which means majority of SOEs may not have private share percentage yet. However, in order to study the influence of increasing private share percentage by using econometric method, we should avoid those huge amount of non-private share SOEs' effect on entire sample size.

*Control Variables* In order to hold for exogenous effects and make model better furthermore as extent of, soft budget constraints, a number of control variables also will be added. According to the previous research and common sense, this study inspected into the crude dataset and kept some variables that would have significant influences on state-owned enterprises' operating efficiency beside private share percentage. These included control variables will be of does your company have a board of directors, major type of activity, which city your company is located, the year your company established, the size of the firm.

Does a state-owned enterprise have a board of directors is an important dummy variables which along with property right theory and budget constraint theory. If a SOE has a board of directors, their business choice will become more market oriental. Shareholders will always find way to maximize their profits meanwhile facing relatively hard budget constrain. Therefore, board as an important control variable is added in this study.

Major type of activity as sectors that SOEs deal with is chosen to be added in our model. Sector will serve as a relevant indicator for the Chinese privatization, for instance the central government liberalized the consumer goods industries (food and textile) faster and earlier than industrial goods industries (petroleum products and processing). As a consequence, industries of consumer goods has been facing a more intense competition with prices which set by the market whereas industrial goods industry has largely been maintained under a dual price track system of official and market pricing systems (Park et al 2006). Since the firms belong to various sector, they might enjoy different profit-making opportunities as certain sectors and industries are associated with different levels of state intervention and promotion (Nee et al 2007).

Which city your company is located is served as a categories variable in order to control for which city the state-owned enterprises are operating in. According to a vast of previous researches, city is often employed and control for as it has been argued to be obviously affected by the political and economic institutions of China, and has a further influence on firm performance especially for state-owned enterprises. Moreover, regional political and economic polices has played an important role in determining SOEs' operating efficiencies. For instance, Shanghai in a southern China, as well as the Special Economic Zones, has initiated more liberalized economic policies, which allows companies greater freedom resulting in greater performance records. Thus, it can be expected that firms in coastal regions tend to outperform firms in other regions due to preferential policies and favorable economic infrastructures (Li 1998).

The year state-owned companies are established which is defined as firm age in this paper.

Some scholars think that, the earlier a SOE is established, the heavier policy burden it is likely to carry and since various Chinese reforms have taken place throughout the country's transition and affecting performance, firm age will thus help control for organizational structure and institutional environment at the time of founding (Lin, Cai and Li 1998). However, accompanying with the age growth, firms can obtain profit accumulations to reinforce their operating system and manage system. Plus, those SOEs that have been established for many years may have more possibility to partially have private share percentage. Furthermore, age should also be controlled for as the Chinese SOEs underwent large-scale restructuring and labor-shedding in the mid 1990's, when the opportunity for laying off workers was opened (Dong and Xu 2009). In addition, the correlation of firm age with SOEs' operating efficiency may not simply be linear, thus I generate a polynomial term of firm age to get a better regression model.

Another control variable is the size of the firm, as commonly used measure of firm size, I pick total employment of SOEs in 2004. The central government is very likely to be more inclined to support or bail out larger firms of more importance, in line with the notion of some firms which relate to core political target being "too big to fail". However, it must be acknowledged that surplus labor in large scale of SOEs might also cause some inefficient operation, therefore, smaller firms usually have lower costs of production, giving these firms the ability to outperform larger firms in terms of profitability (Li 1998)

**4.5 Model Specification and Variables Description**

The hypothesis of private share percentage growth's influence of SOEs' operating efficiency which developed in the previous section will be tested using the Ordinary Least Squares (OLS) method, estimating the sample regression function that minimizes the sum of squared residuals. These two OLS regression models regarding with the nature of the relationship between factors given above with sale efficiency and income efficiency as dependent variables are in the following specification:

$$\text{sale/income\_efficiency} = f(\text{private}, \text{board}, \text{size}, \text{city}, \text{age}, \text{age2}, \text{sector})$$

Model1:

$$\text{sale efficiency}=\alpha+\beta_1\text{private}_{\text{share}}+\beta_2\text{age}+\beta_3\text{age2}+\beta_4\text{sector}+\beta_5\text{city}+\beta_6\text{size}+\beta_7\text{board}+\mu_i$$

Model2:

$$\text{income efficiency}=\alpha+\beta_1\text{private}_{\text{share}}+\beta_2\text{age}+\beta_3\text{age2}+\beta_4\text{sector}+\beta_5\text{city}+\beta_6\text{size}+\beta_7\text{board}+\mu_i$$

Where $\alpha$ is constant, $\beta$ is coefficients of each independent variables and control variables, $\mu_i$ is residuals.

Table 3 Variables Description

| Dependent Variables | |
|---|---|
| Sale efficiency | sale per employee |
| Income efficiency | net income per employee |
| Independent Variable | |
| Private_share | percentage of private ownership |
| Control Variables | |
| board | do company have a board of director |
| size | total employment in 2004 |
| age | firm established year minus 2004 |
| city | which city the firm located in |
| sector | major type of activities of firm |
| age2 | polynomial term of firm age |

After specifying testing model and variables description, summary of the variables are as follow:

**Table 4 Summary statistics Clients**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Dependent Variables | | | | | |
| Sale efficiency | 53 | 30.05073 | 35.2565 | 0 | 185.9019 |
| Income efficiency | 53 | 12.60837 | 48.6334 | -51.0061 | 332.5135 |
| Independent Variable | | | | | |
| Private share | 53 | 58.01887 | 31.1484 | 1 | 98.9 |

| External control Variables | | | | | |
| --- | --- | --- | --- | --- | --- |
| Board (dummy,yes=0 no=1) | 53 | 0.584906 | 0.49745 | 0 | 1 |
| Size | 53 | 3138.566 | 7769.71 | 12 | 52986 |
| Age | 53 | 28.98113 | 19.7323 | 2 | 85 |
| Age2 | 53 | 1221.925 | 1367.68 | 4 | 7225 |
| City (category) | 53 | 17.83019 | 10.8392 | 1 | 37 |
| Sector (category) | 53 | 8.037736 | 3.57320 | 4 | 7225 |

   Given two tables above shows that sale efficiency and net income efficiency are two dependent variables which include sale per employee and income per employ of state-owned enterprises in 2004. The mean sale efficiency among all the SOEs is 30.05073 (thousand yuan/employee) in SOEs which have private share percentage in 2004. The maximum sale efficiency is 185.9 (thousand yuan/employee) and the minimum sale efficiency is 0 (yuan/employee) which is a outlier but I chose to keep it. In my opinion those outliers have a tiny impact on what we are interested in.The mean yearly income efficiency is 12.6 (thousand yuan/employee) in SOEs which have private share percentage in 2004. The maximum yearly income efficiency is 332.5 (thousand yuan/employee) and the minimum yearly income efficiency is minus 51 (thousand yuan/employee). In this dataset, some SOEs which partially owned by individuals have negative income efficiency. This phenomenon is allowed mainly due to debt or something else that block company's performance. From this stastical summary of operating efficiency we can notice that except for some extreme outliers, the mean sale efficiency which equals 30.05 thousand yuan per person and income efficiency which equals 12.6 thousand yuan per person in 2004 of state-owned enterprises is reasonable.

   Where private_share as our crucial independent variable which includes private share percentage of state-owned enterprise. It is a continuous variable. The mean private percentage in state-owned comepanies which have private ownership is 58%. The maximum private share is 98.9% which I think ought to be considered as private onership arrangement to some degree.

However, when we are dealing with Chinese dataset, some times such things happens. The minimum private share is 1% in SOEs. Notice that, in this study we only focus on those SOEs that have private shares, thus the minimum private share could not be 0. From statical summary of private share percentage, we can find that if a state-owned enterprise has private ownership (which includes manager holders, public share, other individual share), usually it will be half or even more among its total share.

Where board is one of the external control variables. It is a dummy variable which includes 0 and 1. 0 stands for the state-owned companiey does have a board of directors, 1 stands for no it does not have one. Given table above shows that among those SOEs have private share percentage there are 22 of them have a board of directors. While 31 of the total dataset do not have a board of directors.

Where firm size is measured by the total employment of the state-owned company in 2004. The mean employment in SOEs is 3138 employee. The minimum number of employment in SOEs is 12 and the maximum is 52986. From this statistical summary of firm size we can see that after a tremendous scale of lay-off in state-owned enterprises during mid-1990s, the average size of SOEs still relatively bigger that other types of companies in China.

Another control variable is the age of the company. The mean age of SOEs is 28 years. The minimum age is 2 years and the maximum age is 85. However, the correlation of age is not simply linear so I generated a new variable age2 which is age squared to give a better explanation of my model. As can be seen from statistical summary of firm age, the average age of these SOEs more or less have been trough Chinese SOEs reform, therefore, theories about SOEs privatization can be suitably used in this study.

In which city to operate a company is also very important. According to the statistical summary above, there are 37 different cities we use in this dataset. Among them, we have first level cities such as Beijing, Shanghai, Guangzhou, Shenzhen, and for second level we have Chongqing, Tianjin, Wuhan and so forth. Notice that, aforementioned SOEs which have huge

size are more likely to operate in first level cities and coastal cities.

Sector as the last control variable is presented here. According to the industry code from National Bureau Statistics of China, here we use a generally separated sector to run the regression, there are 14 types of industries these SOEs are involved which from agricultural and sideline foods processing to waste resources and old material recycling and processing. Although it might only has slight impacts, I still want to keep it in my model as a control variable in order to get better explaination.

## 5. Analyses and Result

### 5.1 Bivariate Analyses

Before proceeding to the multiple regressions of this research，given all the variables, I hereby present the bivariate analyses between private share percentage and sale efficiency, and private share percentage and income efficiency, and other control variables, respectively.

Table 5. Bivariate analyses of private share percentage

| Correlat pwcorr | Private share percentage |
|---|---|
| Sale efficiency | 0.0521 |
| Income efficiency | 0.1824 |

As we mentioned before, given table 5 above is the predicted correlations between private share percentage and sale efficiency and income efficiency. According to this picture, we can see that with private percentage grows up both sale and income efficiency have a significantly positive influence. The degree of correlation between sale efficiency and private share percentage is 0.0521 and the degree of correlation between income efficiency and private share percentage is 0.1824. This prediction matchs those previous theories, SOE's operating efficiency will be deeply accelerated from both inputside and output side due to increasing in private share percentage. When transform froma soft budget constraint to a hard budget constraint state-owned enterprises are pressed to improve operating efficiency so that they can maximize sales proceeds and income.

Table 6. Bivariate analyses of board

| Correlat pwcorr | Board |
|---|---|
| Sale efficiency | -0.1606 |
| Income efficiency | 0.0592 |

As far as I'm concerned, in state-owned enterprises the director of board tends to act more as a supervisory role, and individual responsibility and management more likely to be given downward to individual professional executives (such as a general manager) who deal with specific areas of the firm's affairs. Therefore, I assume that whether SOEs have a board has a significant impact on their operating efficiency in both side. Above table 6 shows that the degree of correlation between sale efficiency and board is -0.1606 and the degree of correlation between income efficiency and board is 0.0592. Surprisingly, board seems to have negative influence on sale efficiency in this prediction. According to this picture, we can see that if a SOE has a board of directors it will have a negetive influence on its sale efficiency. However, a SOE which has a board of directors has better income efficiency compare to those do not have.

Table 7. Bivariate analyses of firm size

| Correlat pwcorr | Firm size |
|---|---|
| Sale efficiency | 0.3311 |
| Income efficiency | 0.0287 |

According to correlation which are predicted in above table 7, the degree of correlation between sale efficiency and firm size is 0.3311 and the degree of correlation between income efficiency and firm size is 0.0287. This bivariate analyses generally matches my assumption that the size of a firm also has a positive impact on its operating efficiency. The bigger size one enterprise has, the more sale/income efficiency can they have.

Table 8. Bivariate analyses of firm age

| Correlat pwcorr | Firm age |
|---|---|
| Sale efficiency | 0.0444 |
| Income efficiency | -0.1634 |

Given figure above show the predicted correlation between state-owned enterprise's age and

its operating efficiency. The degree of correlation between sale efficiency and firm age is around 0.0444 and the degree of correlation between income efficiency and firm age is -0.1634. The established year for companies might also has correlation with operating efficiency. As far as I'm concerned, accompanying with the age growth, firms can obtain profit accumulations to reinforce their operating system and manage system. Plus, those SOEs that have been established for many years may have more possibility to partially have private share percentage. It can be seen that the age of SOEs has positive influence on its sale efficiency. However, it has negative impact on SOEs' income efficiency.

Table 9. Bivariate analyses of firm age2

| Correlat pwcorr | Firm age2 |
|---|---|
| Sale efficiency | 0.1334 |
| Income efficiency | -0.0970 |

Given table above shows that along with previous analysis, firm age2 as the polynamial term of firm age also has a positive influence on sale efficiency and negative impact on income efficiency. The degree of correlation between sale efficiency and firm age2 is 0.1334 and the degree of correlation between income efficiency and firm age2 is -0.0970.

Table 10. Bivariate analyses of city

| Correlat pwcorr | City |
|---|---|
| Sale efficiency | 0.0941 |
| Income efficiency | 0.1309 |

Usually, more developed city has higher level of infrastructure, better property rights protection and more incentive policies which facilitate SOEs to have private share and better operating efficiency. For instance, I assume that SOEs in Beijing and Shanghai are more efficient than other SOEs in developing cities when running a business. As a result, these advanced cities have positive impact on operating efficiency. Therefore, I use city as a control variable. According to given table 10 above, the degree of correlation between sale efficiency and city is 0.0941 and the degree of correlation between income efficiency and city is 0.1309.

Table 11. Bivariate analyses of sector

| Correlat pwcorr | Sector |
|---|---|

| | |
|---|---|
| Sale efficiency | 0.2260 |
| Income efficiency | 0.1324 |

Different industry a state-owned enterprise has might also lead to different percentage of private share requirement. What's more different sector will also have different treatment from the central government. Some core industries are more like to obtain policy support. In my opinion, sector has significant influence on SOEs' operating efficiency. Based on table 11 above we can see that the degree of correlation between sale efficiency and sector equals 0.2260 which is relatively high and the degree of correlation between income efficiency and sector is 0.1324.

**5.2 Model Estimation and Hypothesis Result**

Model Estimation

  Before showing and discussing the results of the OLS model estimation further, a note on the diagnostic status of the model is needed. Several diagnostic tests have been conducted in order to ensure the appropriateness of using the model, testing for omitted variable, absence of multicollinearity, and heteroskedasticity. Results for these test can be seen in Appendix tables below, a link test was performed to exam whether these two models are suffer from omitted variable or not. As the P-value of hat in both regressions is 0 in a 1% significance level, they are not suffer from omitted variable. These models also did not show signs of multicollineraity as the mean of variance inflation factors (VIF) varied between 2.35 to 2.37. Notice that, at first time two regressions did suffer from multicollineraity problem due to the introduction of polynomial term of firm age. What's more, the using of age squared does not significantly improve the levels of significance nor improve the adjusted r-squared. Therefore, I dropped age2 to avoid multicollineraity problem and to improve testing models. The Breusch -Pagan LM test was performed on the two models resulting in that two models can not reject the null hypotheses of no heteroskedasticity.

Hypothesis Result and Discussion

Given table 12 below presents a summary of the regression results with two extra tables in Appendix providing a more detailed presentation of the estimated coefficients.

**Table 12 Results of OLS Regression Analysis**

| OLS of SOE operating efficiency | | |
|---|---|---|
| | Model 1 | Model 2 |
| **Dependent Variable** | Sale efficiency | Income efficiency |
| **Private share percentage** | 0.1964** | 1.7372*** |
| | (0.3106) | (0.3306) |
| **External control variables** | | |
| **Board** | 8.4796* | 78.759*** |
| | (16.22) | (17.267) |
| **Firm size** | 0.0047* | 0.0056* |
| | (0.0026) | (0.0028) |
| **Firm age** | 3.4246** | 1.1080** |
| | (2.2260) | (2.3697) |
| **City1** (full content see in Appendix) | -22.76951** | -111.3126** |
| | (2.925346) | (44.14635) |
| | (results shorted here) | (results shorted here) |
| **Sector1** (full content see in Appendix) | 26.72116** | 330.9164** |
| | (5.263145) | (42.40203) |
| | (results shorted here) | (results shorted here) |
| **Constant** | -58.976 | -190.61** |
| | (57.731) | (61.458) |
| **Observations** | 53 | 53 |
| **Adjusted R-squared** | 0.381 | 0.631 |
| **Standard errors in parentheses** *** p<0.01, ** p<0.05, * p<0.1 | | |

According to the regression result above, we can observe that Adjust R-squared values are relatively high in both models which means these two models are statistically convincible. For model1 sale efficiency side, the P-value of our independent variable private share percentage is less than 0.05 which means that its coefficient is statistically significant at 95% confidence level. Moreover considering the Adjust R-squared value of the entire model is 0.3807 which is high enough and the slope coefficient of the private share percentage is consistent with the hypothesized effects specified in H1. As I expected in research question part, the coefficient of private share percentage is positive 0.1964 which means that 1% increasing in state-owned enterprises' private share percentage will lead to 0.1964(thousand yuan/per worker) increasing in SOEs' sale efficiency. Regarding the Chinese context, I would say that almost two hundred yuan annual sale growth per worker is absolutely a significant positive influence.

The P-values of board variable in model1 is less than 0.1 which means its coefficients are statistically significant at 90% confidence level. Along with my expectation, it is shown that if a state-owned enterprise has a board of directors will increase more 8.4796(thousand yuan/per woker) in sale efficiency than those SOEs don't have. In addition, compare to the bivariate analyses of board which shows a negative correlation between sale efficiency and the board of directors, in the final regression result board variable has a positive impact on sale efficiency. The P-values of firm size variable in model1 is less than 0.1 which means its coefficients are statistically significant at 90% confidence level. The coefficient of firm size equals positive 0.0047 which means that 1 worker increasing will lead to 0.0047(thousand yuan/per worker) increasing in sale efficiency. This result is also consistent with my expectation and as we can see here though the coefficient of firm size is very slight, the positive influence of firm size on sale efficiency is definitely statistically significant. The P-values of control variable firm age in model1 is statistically significant at 95% significant level which equals less than 0.05. Hence, the coefficient of firm age equals positive 3.4246 which means that 1 year age increasing will lead to 3.4246 (thousand yuan/per worker) increasing in state-owned enterprises' sale efficiencies. For the city categories with Zhengzhou as omitted variable and reference category most of the cities report significant coefficients and mainly along with my expectation. For the cities which more is more developed than Zhengzhou such as Beijing and Tianjin, their state-

owned enterprises are incline to have better sale efficiency. And as I know Zhengzhou is one of the industrial cities in China, compare to some less developed cities like Lanzhou and Guilin, SOEs in Zhengzhou will have better sale efficiency. This result supports that more developed city has higher level of infrastructure, better property rights protection and more incentive policies which facilitate SOEs to have private share and better operating efficiency. From the dummy variables of sector, we can observe that, with nonmetal mineral products as omitted variable and reference category, most of the sectors report significant coefficients and mainly along with my expectation. For instance, SOE which deal with beverage production has 81.73(thousand yuan/per worker) more sale efficiency than nonmetal mineral production companies. In general, though the independent variable has relatively slight positive influence on SOEs' sale efficiency, the P-value is less than 0.05 shows that it is still consistent with my null hypothesis 1 that growth of private share percentage improves state-owned companies' sale efficiency. Considering Adjust R-squared value is 0.3807 which illustrates model1 has high explantory power, thus I can not reject my null hypothesis H1. For the slight influence on sale efficiency problem of private share percentage could mainly due to the sample size is too small that consider with Chinese context, state-owned enterprises seldom have private share percentages.

For model2 income efficiency side, we obtained an even higher explanatory power regression with Adjust R-squared value which equals 0.631. The P-values of our independent variable private share percentage is less than 0.01 which means its coefficient is statistically significant even at 99% confidence level. The coefficient of private share percentage is positive 1.7372 which means that 1% increasing in state-owned enterprises' private share percentage will lead to 1.7372(thousand yuan/per worker) increasing in SOEs income efficiency. Comparing to model1, the coefficient in model two is relatively greater which shows private share percentage has more positive impact on income efficiency.

Most of the control variables in model2 are significant. The P-values of board variable in model2 is less than 0.01 which means its coefficients are statistically significant at 99% confidence level. Along with my expectation, it is shown that if a state-owned enterprise has a

board of directors will increase more 78.759 (thousand yuan/per woker) in income efficiency than those SOEs don't have. Comparing to model1's 8.4796(thousand yuan/per woker) in sale efficiency here we can see, in income efficiency side whether a SOE has a board of directors is more important than sale efficiency side. The P-values of firm size variable in model2 is less than 0.1 which means its coefficient is statistically significant at 90% confidence level. The coefficient of firm size equals positive 0.0056 which means that 1 worker increasing will lead to 0.0056 (thousand yuan/per worker) increasing in sale efficiency. Again this result is also consistent with my expectation and as we can see here the coefficient of firm size in model2 is also very slight but the positive influence of firm size on income efficiency is definitely statistically significant. Another control variable firm age's P-values in model2 is statistically significant at 95% significant level which equals less than 0.05. Hence, the coefficient of firm age equals positive 1.1080 which means that 1 year age increasing will lead to 1.1080 (thousand yuan/per worker) increasing in state-owned enterprises' income efficiencies. For the city dummies in model2, I also use Zhengzhou as omitted variable and reference category. Most of the cities report significant coefficients and mainly along with my expectation. Compare to first level cities, state-owned enterprises in Zhengzhou has less income efficiency. However, some cities which are less developed than Zhengzhou have less income efficiency. For the dummy variables of sector, the nonmetal mineral products is still used as omitted variable and reference category. Coefficients of different sectors are mainly statistically significant. Therefore considering the combination of the Adjust R-squared value 0.631 and the P-values of our independent variable private share percentage is less than 0.01 in model2, income efficient model's result can not reject the null hypothesis 2 that growth of private share percentage is conducive to state-owned companies' income efficiency.

In addition, in these two models please notice that control variable age was insignificant in both regression when with age2 together, because of multicollinearity problems. Therefore aforementioned polynomial term of age is excluded artificially in both regressions. Similar matters also happened in variable sets of sector dummies, four sectors were omitted by STATA due to collinearity. The entire regression results with full set of dummies is presented in the Appendix.

## 6. Conclusion

My initial motivation was to dig into the dynamics that how private share percentage in SOE affect its operating efficiency. In order to do so, I chose the scope to look at the correlations between private share percentage, sale efficiency and income efficiency. By presenting the overview and current state of SOEs in China, I addressed the importance of studies on SOEs reform. And to be more specific, conduct a quantitative way to research on one aspect of privatization of Chinese state-owned enterprises (increasing of private share percentage). While due to the limitation of dataset accessibility and accuracy, only state-owned enterprises which have private share percentage in 2004 were studied. This thesis is defined as the analysis on domestic micro-data instead of group or macro-level data which cross countries, the variables and figures are still relatively narrow as to study private share percentages' impact on SOEs' operating efficiency in a global context. Therefore, the thesis has limitations on both data source and study scope. In other word, my result can only focus on phenomenon explanation rather than analyze entire institutional reform. The content of research is further narrowed down to the base number of SOEs is comparatively larger than target SOEs (those have private share percentage). The scale of sample size directly relate to the applied range of empirical testing result. That is to say, sometimes the final outcome might be a little bit over fitted.

Accordingly, I have initiated the key research question to investigate the impact of private share percentage on SOEs' operating efficiency in China. I have found that most of the initially assumed variables have strong or significant correlations with the operating efficiency such as whether SOEs have a board of directors, firm's size, firm's age and so forth. Especially for the independent variable, private share percentage has significantly positive influence on both sale efficiency and income efficiency in state-owned enterprises. Thus I can not reject my null hypothesis that private share percentage has positive impact on state-own enterprises' operating

efficiency in China. This result is conducive to those opinions which support reforms in state-owned enterprises in China. As the private degree in SOEs raising, the operating efficiency also grows up. According to the statistical analysis, operating efficiency is significantly higher when a SOE has more private share percentage. It means growth of private share percentage improved operating efficiency without demanding any costs on SOEs' output, profitability, input and so forth. This result was interpreted along with the budget constraint perspective. As far as I'm concern, if SOEs want to get better performance in the future, they should have more private share percentage and a board of directors as well.

SOEs in China are always face with soft budget constraints, and as a consequence, the inefficiency of the company was embedded in the structure. However, in this paper I found that growth of private share improved operating efficiency significantly. Thus, it might be that the growth of private share hardened the budget constraint and it affected SOEs' economic performance. The budget constraint is hard if persistent loss is a matter of life and death; the more the loss maker is spared from tragic consequences, the softer is the constraint. General Managers perceive increasing private share percentage as a threat which can block all sources of the soft budget constraint. Those sources can be explained as the rent of SOEs, and the interest groups try hard to maintain it. The softening is that the decision maker expects such external financial assistance with high probability, and this probability is built firmly into his behavior. Such rent-seeking behaviors generally created corruption or illegal activities in the past, but it can also be a good incentive to operation efficiently in good anti-corruption, and this incentive strongly activates under the growth of private share percentage.

From this single perspective, the central government should continue with increasing SOEs' private share percentage instead of keeping the largest and most important SOEs under control. However, we couldn't simply draw a conclusion that comprehensive privatization in Chinese SOEs is the only way to solve SOEs' inefficient problem. As many scholars said, privatization is not the only method to bring about changes in managerial goals and towards competitive environment, if we want to figure out the whole institutional change method, we need to take more factors into account for instance public choice, agency theory, interest group theory and

so forth. Furthermore, from many previous studies we can learn the fact that the companies with higher efficiency may have been more efficient even before they became subject to SOE. For instance, as many studies pointed out that private companies are more efficient than SOEs. Therefore, we also need to be aware of this adverse selection problem. Based on my outcomes state-owned enterprises' reform seems to be accomplished by more gradual approaches, due to the influence of private share percentage on sale and income efficiency side is around a relatively slight degree. In addition, my study has time and dataset limitations which only can be focused on a small scale of SOEs, with time passing on, more and more researches need to be done in relevant aspects by using more recent data source and larger scale of SOEs in China.

## 7. References

Bai, C., J. Lu, and Z. Tao (2005). "Divergent Interests between Central and Local Governments: Testing Theories of Public Ownership." Working Paper, Hong Kong Institute of Economics and Business Strategy.

Bryman, Alan, (2008), 'Social research methods', 3rd ed., Oxford University Press, pp.44

Boardman, Anthony and Aidan R. Vining. 1989. "Ownership and Performance in Competitive Environments: A Comparison of the Performance of Private, Mixed, and State-Owned Enterprises," Journal of Law and Economics 32, pp. 1-33

Cuervo, A., Villalonga, B. (2000), Explaining the variance in the performance effects of privatization, Academy of Management Review, Vol. 25 No.3, pp.581-90.

Gregory C. Chow (2009), Important Lessons from Studying the Chinese Economy. Princeton University Working Paper No.1198.

Dewenter, Kathryn and Paul H. Malatesta. 2000. "State-Owned and Privately-Owned Firms: An Empirical Analysis of Profitability, Leverage, and Labor Intensity," American Economic Review, forthcoming.

Dong, X. and Xu, L. (2009). "Labor Restructuring in China: Toward a Functioning Labor market", Journal of Comparative Economics 37: pp. 287-305.

Djankov, Simon and Peter Murrell. 2002. "Enterprise Restructuring in Transition: A Quantitative Survey." Journal of Economic Literature, 40(3):739-792.

Demsetz, Harold. 1967. "Toward a Theory of Property Rights." American Economic Review, 57(2): 347-59.

Friedmann W. and Garner J. F. (1970) Government Enterprises: A Comparative Study, London: Sevens.

Frydman, R., C. Gary, M. Hessel and A. Rapaczynski (1999). "When Does Privatization Work? The Impact of Private ownership on Corporate Performance in the Transition Economies." Quarterly Journal of Economics 114(4): 1153-1191.

Functions and Organizational Structure of the National Bureau of Statistics, 2007 (http://www.stats.gov.cn/english/nbs/t20070104_402377418.htm)

Junki Kim and Hongkyou Chung (2007). "Empirical Study on the Performance of State-owned-enterprises and the Privatizing Pressure: The Case of Korea.", Graduate School of Public Administration, Seoul National University

Jefferson, G. H. and J. Su (2005). Privatization and Restructuring in China: Evidence from Shareholding Ownership, 1995-2001. Working Paper.

Li, Weiye, and Louise Putterman. "Reforming China's SOEs: An Overview." Comparative Economic Studies 50, no. 3 (2008): 353-380

Li, S. (1998), "Success in China's Industrial Market: An Institutional and Environmental Approach", Journal of International Marketing, Vol. 6, No. 1, pp. 56-80

Li, S., and Xia, J. (2008), "The Roles and Performance of State Firms and Non-State Firms in China's Economic Transition", World Development, Vol. 36, No. 1, pp. 39 -54

Lin, J., Cai, F. and Li, Z. (1998). "Competition, Policy Burdens, and State-Owned Enterprise Reform". The American Economic Review, (2), pp. 422-427

Magginson, William L., Robert C. Nash, and Mattias van Randerbough, (1994), The Financial and Operating Performance of Newly Privatize Firms: An International Empirical Analysis, The Journal of Finance, 49(2): 403-452.

Megginson, W. L. and J. M. Netter (2001). "From State to Market: A Survey of Empirical Studies on Privatization." Journal of Economic Literature 39(2): 321-389.

Niskanen, W. 1971. Bureaucracy and Representative Government. Chicago: Aldine-Atherton.

Nee, V., Opper, S., and Wong, S. (2007), "Developmental State and Corporate Governance in China", Management and Organization Review, 3:1, pp. 19-53

National Bureau of Statistics (NBS) 1999, China Statistical Yearbook 1999, Chapter 5, China Statistics Press, Beijing.

National Bureau of Statistics (NBS) 2004, Investment Climate Survey,

National Bureau of Statistics (NBS) 2007, China Statistical Yearbook 2007, China Statistics Press, Beijing.

Opper, Sonja. 2004. "The Political Economy of Privatization: Empirical Evidence from Transition Economies." Kyklos 57(4): 567-594.

OECD Working Group on Privatisation and Corporate Governance of State Owned Assets, "State Owned Enterprises in China: Reviewing the Evidence", 26 January 2009

Park, S.H., Li, S., and Tse, D.K. (2006), "Market Liberalization and Firm Performance during China's Transition", Journal of International Business Studies, Vol. 37, No. 1, pp. 127-147

Wei, Zuobao, Oscar Varela, Juliet D'Souza, and M. Kabir Hassan, (2003). The Financial and Operating Performance of China's Newly Privatized Firms, Financial Management, 32(2): 107-126.

Wang, X., L. C. Xu and T. Zhu (2004). "State-owned enterprises going public: The case of China." Economics of Transition 12(3): 467-487.

Wu, Fulong, Jiang Xu, and Anthony Gar-On Yeh. Urban development in post-reform China: state, market, and space. Vol. 15. Taylor & Francis, 2006.

Xiazhe, Huang, 2012, Study on China and the Asia Pacific: Chinese economy growth experience compare with East Asian countries, EKHM 31 Assignment 1, Master Program of International Economics with a Focus on China

Xiazhe, Huang, 2013, Study on Institutions, Markets and Firms in a Chinese Context: The influences of private share percentage in SOEs on their operating efficiencies, NEKN 71 course paper, Master Program of International Economics with a Focus on China

**Appendix**

**Table 1 omitted variable test of sale efficiency model**

| Linktest | | | | |
|---|---|---|---|---|
| Sale efficiency | Coefficients | Std Err | t | P-values |
| _hat | 0.9688115 | 0.1287779 | 7.52 | 0.000 |
| _hatsq | 0.0002179 | 0.0008234 | 0.26 | 0.792 |
| _cons | 0.5062728 | 2.99965 | 0.17 | 0.867 |
| Adj R-squared 0.8763 | Number of obs 53 | Root MSE 12.4 | | |

**Table 2 omitted variable test of income efficiency model**

| Linktest | | | | |
|---|---|---|---|---|
| Income efficiency | Coefficients | Std Err | t | P-values |
| _hat | 0.6308802 | 0.0675681 | 9.34 | 0.000 |
| _hatsq | 0.0015042 | 0.0002475 | 6.08 | 0.000 |
| _cons | 1.171867 | 1.438728 | 0.81 | 0.419 |
| Adj R-squared 0.9576 | Number of obs 53 | Root MSE 10.017 | | |

**Table 3 variable multicollinearity test (VIF test)**

| | Mean VIF |
|---|---|
| Sale efficiency model | 2.37 |

| Income efficiency model | 2.35 |
|---|---|

**Table 5 heteroskedasticity test of income efficiency model**

| Breusch-Pagan/Cook-Weisberg test for heteroskedasticity | |
|---|---|
| Ho: Constant variance | Variables: fitted values of income_eff |
| Chi2(1) | 3.77 |
| Prob>chi2 | 0.0522 |

**Table 6 heteroskedasticity test of sale efficiency model**

| Breusch-Pagan/Cook-Weisberg test for heteroskedasticity | |
|---|---|
| Ho: Constant variance | Variables: fitted values of sale_eff |
| Chi2(1) | 2.87 |
| Prob>chi2 | 0.0900 |

**Table 7 Regression results, including full set of city-dummies and sector-dummies**

| OLS of SOE operating efficiency | | |
|---|---|---|
| | Model 1 | Model 2 |
| **Dependent Variable** | Sale efficiency | Income efficiency |
| **Private share percentage** | 0.1964** | 1.7372*** |
| | (0.3106) | (0.3306) |
| **External control variables** | | |
| **Board** | 8.4796* | 78.759*** |
| | (16.22) | (17.267) |
| **Firm size** | 0.0047* | 0.0056* |
| | (0.0026) | (0.0028) |

| | | |
|---|---|---|
| **Firm age** | 3.4246** | 1.1080** |
| | (2.2260) | (2.3697) |
| **City** | | |
| **Beijing** | 43.79417** | 63.60775 |
| | (1.598249) | (38.02217) |
| **Benxi** | -9.724651 | 45.5766 |
| | (3.779988) | (45.16841) |
| **Chengde** | -22.76951** | -111.3126** |
| | (2.925346) | (44.14635) |
| **Chengdu** | -113.9734*** | -99.49117** |
| | (2.200028) | (44.12623) |
| **Chongqing** | -118.1934*** | -144.149*** |
| | (2.355035) | (44.92622) |
| **Chuzhou** | -40.40978** | -40.41642 |
| | (1.917247) | (40.72026) |
| **Datong** | -16.39393** | -56.06732* |
| | (1.790974) | (29.48084) |
| **Guangzhou** | 60.07594** | -8.326633 |
| | (1.726448) | (37.464) |
| **Guilin** | 47.06566** | -47.64687 |
| | (1.889489) | (28.28788) |
| **Guiyang** | 37.6947** | 9.685263 |
| | (2.160723) | (32.78151) |
| **Haerbing** | -4.105278 | -19.10843 |
| | (1.710317) | (39.81724) |
| **Handan** | 129.9602*** | 35.34258 |
| | (2.849986) | (46.922) |
| **Hengyang** | -23.18572** | -102.515** |

| | | |
|---|---|---|
| | (2.860705) | (42.15429) |
| **Huanggang** | 23.95449*** | 12.90824 |
| | (23.95449) | (46.93509) |
| **Jinan** | 37.44528*** | 63.30057 |
| | (37.44528) | (42.79107) |
| **Jingzhou** | 52.49475*** | 101.9819** |
| | (2.239658) | (39.11414) |
| **Kunming** | 145.6765*** | -85.60912* |
| | (4.797156) | (43.53407) |
| **Lanzhou** | -12.67015** | 1.873024 |
| | (1.560728) | (40.19756) |
| **Luoyang** | -258.4633*** | -54.35393 |
| | (3.361096) | (52.74992) |
| **Maoming** | 75.44737*** | 13.61538 |
| | (2.224382) | (47.91861) |
| **Nanchang** | 42.28749*** | -88.21836** |
| | (3.7574) | (36.82201) |
| **Nanjing** | 28.45645** | -11.42461 |
| | (2.933095) | (45.2872) |
| **Qujing** | 8.883216* | 163.6542*** |
| | (2.2767) | (31.42687) |
| **Shangqiu** | 13.44246** | 47.25591 |
| | (1.909765) | (40.81312) |
| **Shenyang** | 32.15769*** | -4.25478 |
| | (1.903048) | (31.96754) |
| **Shijiazhuang** | 17.74497** | -68.5318 |
| | (2.71625) | (42.67986) |
| **Tangshan** | 276.8844*** | 89.58325 |
| | (4.893856) | (70.68893) |

| | | |
|---|---|---|
| **Tianjin** | 22.20062*** | -41.56327 |
| | (2.144686) | (32.34026) |
| **Tianshui** | 25.9086** | -135.4664*** |
| | (3.1874) | (35.39101) |
| **Weifang** | 27.72189*** | -23.59237 |
| | (2.39754) | (45.08895) |
| **Xi'an** | 113.782*** | -7.48458 |
| | (1.727798) | (40.72434) |
| **Xianyang** | 73.92255*** | 9.197159 |
| | (2.888837) | (46.14543) |
| **Xuzhou** | -4.804994* | 1.327968 |
| | (1.62534) | (37.97302) |
| **Zhengzhou** | 32.99824* | -34.68642 |
| | (2.24297) | (30.99895) |
| **Zibo** | 108.6679*** | 45.54446 |
| | (1.98106) | (38.61417) |
| **Zunyi** | 80.0781*** | -36.10043 |
| | (2.46517) | (46.06378) |
| **Sector** | | |
| **Textile Industry** | -69.33957*** | -13.57791 |
| | (1.861146) | (14.99415) |
| **Chemical Products** | -14.11091** | -30.12303 |
| | (1.48402) | (11.95587) |
| **Medical products** | 81.73253*** | 33.21141 |
| | (2.942181) | (23.70341) |
| **Nonmetal Mineral Products** | -36.76195*** | -27.17854 |
| | (1.226656) | (9.882436) |
| **Smelting of Ferrous Metals** | -67.22919*** | -24.94104 |

| | | |
|---|---|---|
| | (2.377407) | (19.15336) |
| **Smelting of Non-ferrous Metals** | 26.72116** | 330.9164** |
| | (5.263145) | (42.40203) |
| **Ordinary Machinery Manufacturing** | 53.72494*** | 18.43071 |
| | (1.920272) | (15.47049) |
| **Special Equipment Manufacturing** | -54.53695*** | -22.75233 |
| | (1.122459) | (9.042987) |
| **Transport Equipment Manufacturing** | -26.27187*** | -10.4117 |
| | (1.492628) | (12.02522) |
| **Constant** | -58.976 | -190.61** |
| | (57.731) | (61.458) |
| **Observations** | 53 | 53 |
| **Adjusted R-squared** | 0.381 | 0.631 |
| **Standard errors in parentheses** *** p<0.01, ** p<0.05, * p<0.1 | | |

**Note: Sector beverage production, leather and related products, electric machines and apparatuses manufacturing, communications equipment, computer and other electronic equipment manufacturing were omitted by STATA due to collinearity.**