POLICY, AGGREGATE PRODUCTIVITY AND MISALLOCATION

Guowen Chen
University of Kentucky, gch235@g.uky.edu
Digital Object Identifier: https://doi.org/10.13023/etd.2019.318

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Guowen Chen, Student

Dr. Ana María Herrera, Major Professor

Dr. Josh Ederington, Director of Graduate Studies

POLICY, AGGREGATE PRODUCTIVITY AND MISALLOCATION

DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Business and Economics at the University of Kentucky

By

Guowen Chen

Lexington, Kentucky

Director: Dr. Ana María Herrera, Professor of Economics

Lexington, Kentucky

ABSTRACT OF DISSERTATION

POLICY, AGGREGATE PRODUCTIVITY AND MISALLOCATION

This dissertation explores the effects of factors such as industrial policy and listing on the stock market on manufacturing firms' profitability and productivity.

The second chapter investigates the effect of industrial policies on misallocation using a rich data-set of Chinese firms. Using a difference-in-difference approach, I provide evidence that government policies (i.e. the 10th Five Year Plan) favoring particular industries lead to increased misallocation (i.e., an increase in the dispersion of revenue productivity across firms in four-digit industries). Moreover, the differential changes between industries supported and not supported by the 10th Five Year Plan are quantitatively large and indicative of a substantial negative impact on aggregate TFP. Using a changes-in-changes model, I find evidence that the Five Year Plan had a positive and significant effect for most of the TFPR distribution while the effect was negative for the lowest quintile of TFPQ and positive for the highest TFPQ quintile. The results suggest increased misallocation is related to the way in which the Chinese government doled out support through the increase of subsidies and the improvement of credit conditions for a subset of firms.

In the third chapter, I study the heterogeneous effects of an industrial policy - the 10th Five Year Plan on misallocation, profitability and real technology in Chinese provinces with different mix of supported intensities. I find that the 10th Five Year Plan increased misallocation, profitability and technology of supported industries in provinces with higher supporting intensities. After controlling the effects of China's state-owned enterprise (SOE) reforms and joining into World Trade Organization (WTO), the results are still robust and consistent.

In the fourth chapter, I investigate the effects of listing on the stock market on firm's profitability and technology. Using Chinese firm level data, I identify listing firms, and compute revenue productivity and physical productivity to measure profitability and technology, respectively. To deal with the endogenous problem of listing, I use the number of investment banks as instrument variable. With a difference-in-difference model, I find that listing increases firm's profitability and technology. Empirical findings also reveal that listing changes characteristics of firms, such as asset,

liability and capital structure.

KEYWORDS: Misallocation, Industrial Policy, Listing, Profitability, Technology

Author's signature: Guowen Chen

Date: July 16, 2019

POLICY, AGGREGATE PRODUCTIVITY AND MISALLOCATION

By
Guowen Chen

Director of Dissertation: Dr. Ana María Herrera

Director of Graduate Studies: Dr. Josh Ederington

Date: July 16, 2019

I dedicate this dissertation to my parents, Naiyou Chen and Tian'ai Qiao, and my brother, Zhao Chen, who supported and encouraged me every step of the way.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation and thanks to my advisor, Dr. Ana María Herrera, for her unwavering support and guidance throughout the duration of my doctoral studies at the University of Kentucky. I am extremely thankful for Dr. Herrera’s encouragement and patience with me during the challenging process of writing this dissertation. I would also like to thank the rest of my committee members, Dr. Steven Lugauer, Dr. Jenny Minier and Dr. Mark Liu, for their invaluable advice, insightful comments, and guidance. I would also like to thank Dr. Leonce Bargeron for serving as the outside examiner to my dissertation defense.

I am thankful to Dr. William Hoyt for having faith in me and giving me the opportunities to be a teaching assistant at the University of Kentucky. I would also like to thank Dr. Adib Bagh, Dr. Felipe Benguria, Dr. Charles Courtemanche, Dr. Josh Ederington, Dr. William Hoyt, and Dr. Carlos Lamarche for their helpful advice and comments during the writing of the dissertation. I would also like to thank Dr. Bob Gillette, Dr. Alejandro Dellachiesa, Dr. Gail Hoyt and Dr. Darshak Patel for their useful teaching advice.

Last but not the least, I would like to thank my parents, Naiyou Chen and Tian’ai Qiao, for their unconditional love all the time. I would like to thank my brother Zhao Chen. And I would also like to thank Heyuan Wang, Weifeng Ma, Guomao Sun, and many other important family members, friends, and mentors who gave me support.

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Chapter 1 Introduction

Misallocation will affect the differences in living standards between rich and poor countries by lowering aggregate productivity. When labor and capital are not put to their best or most efficient use, total production is, quite obviously, lower. Government industrial policy can influence productivity across firms and misallocation across industries. In the second chapter, I focus on the effects of government policy on misallocation.

As to government policy, I focus on the most important industrial policy in China, the Five Year Plan, to examine the effects of the Plan on misallocation. The Five Year Plans are made by the central government every 5 years to guide economic and investment activities. I use the 10th Five Year Plan because the data is from 1998 to 2005, and the 10th Five Year Plan is from 2001 to 2005. The official document allows us to match narrowly defined supported industries with the corresponding 4-digit industry code. As to why are these industries supported, we could not be able to infer all the reasons. For example, the Plan intended to improve socialist, spiritual civilization, ensure stability, and so on.

I follow Hsieh and Klenow (2009) to measure misallocation, which misallocation is measured by the variance of revenue productivity. Revenue productivity should be equal across firms within industry. Therefore, the smaller of the variance of revenue productivity, the higher of total factor productivity of the industry.

The data used in the chapter is from the Annual Surveys of Chinese Manufacturing from 1998 to 2005. It includes all state-owned and non-state-owned firms with nominal revenues exceeding 5 million yuan. The number of observations ranges from about 165,000 in 1998 to 269,000 in 2005. I used firm's value-added, wage payments, and capital stock to compute revenue productivity and misallocation.

With a difference-in-difference approach, I test the effects of the 10th Five Year Plan on misallocation. I find that the 10th Five Year Plan increases misallocation of supported industries, which in specific the 10th Five Year Plan increases misallocation by around 6.4% after 2000. Moreover, empirical results show that the Five Year Plan increases profitability of supported industries, but has no significant effects on technology of supported industries. As profitability is equal to price times technology, which means the Five Year Plan only increases the markup of supported industries.

I further examine the heterogeneous effects of the Five Year Plan on the distributions of revenue and physical productivity. The results show that the Five Year Plan increases firm's revenue productivity at most distributions, but only have negative effects on technology of firms at the bottom percentiles, and positive effects on technology of firms at the top percentiles, which one possible reason is that the governments support firms with lower technology level to keep them survive. In addition, I investigate the mechanism of how does the Five Year Plan work on misallocation. Starting with the three most commonly used methods by government, which they are tax reduction, subsidy and access to credit, I find evidence that the Five Year Plan increases misallocation by direct subsidies and better credit condition.

I take a new approach by focusing on the unequal effects of industrial policy across provinces in the third chapter. A large and growing literature has investigated the effects of industrial policies on economic outcomes such as growth and productivity. However, the effects of the same industrial policy might vary across different regions. Using Chinese manufacturing firm-level data, I examine whether there are unequal effects of the most important industrial policy in China, the Five Year Plan, on misallocation, profitability and real technology.

Consistent with chapter 2, I use the variance of revenue productivity within an industry to measure misallocation, revenue productivity to measure profitability and physical productivity to measure technology. As local governments are the executors of the industrial policy, local governments might support the targeting industries differently due to different economic status of the supported industries. I introduce supporting intensity, which it is the share of value-added of supported industries in a province to denote supporting intensity in that province, to capture the difference of the same industrial policy across provinces in China. Using a difference-in-difference model, I confirm the findings of the former chapter. Industrial policy increases misallocation and profitability. However, the Five Year Plan has a positive effect on the technology levels of provinces with higher supporting intensities.

I address the question what changes do listing on a stock market bring to firms' productivity and profitability in the fourth chapter. However, the decision to be listed on the stock market for firms can be endogenous due to reverse causality and unobserved variables. I use the number of investment bank in a city as the instrument variable to tackle the endogenous effects. The number of investment banks in a city has no correlation with firms' profitability or technology except via listing.

The data about firm's information is from Chinese firm-level data from the Annual Surveys of Industrial Production, and the information about listing is from WIND data base. With propensity score match method and a difference-in-difference model, I find that listing on a stock exchange increases firm's profitability and technology. The results are consistent after controlling for the geographic effects and SOE reforms.

Chapter 2 Policy and Misallocation

2.1 Introduction

A large and growing literature has argued that misallocation contributes substantially to the differences in living standards between rich and poor countries [1]. When labor and capital are not put to their best or most efficient use, total production is, quite obviously, lower. Misallocation can happen for a variety reasons including constraints on factor mobility from financial frictions or employment restrictions, taxes or trade policy, or the government explicitly fostering certain industries for political or other reasons. Our analysis concerns the last of these: direct government intervention.

We provide evidence that government policies favoring particular industries or firms lead to misallocation. In particular, we estimate the effect of China's Five Year Plans using micro-level data on Chinese firms. The misallocation of resources within industries supported by the 10th Five Year Plan increases relative to not supported industries. We measure misallocation as the dispersion of revenue productivity (price times total factor productivity) across firms in an industry; the differential changes in this dispersion for supported industries versus not supported industries is quantitatively large, indicating that this type of misallocation is important for understanding productivity differences both within and across countries.

Since the foundation of the People's Republic of China, the central government has controlled economic activity by making explicit policies to direct the deployment of resources. The plans are usually updated every five years. Although almost all countries have some policies favoring certain firms or industries, China's economy-wide re-shuffling of economic priorities makes for a poignant case study. We use information from the Annual Survey of Industrial Production, which contains data on Chinese firms from 1998 to 2005, to estimate the misallocation due to the centralized planning in

1 See Restuccia and Rogerson (2017) and the many papers cited within.

China. The survey covers a large sample of firms included in the manufacturing industries that were the target of the 10th Five Year Plan, and it also includes industries that were neither targeted by this plan, nor by the 9th Five Year Plan. Hence, the data is well-suited to our needs, as it allows us to identify the effects of the 10th Five Year Plan by comparing differences in misallocation between supported and not supported industries.

Our work is closely related to that of Hsieh and Klenow (2009) who use the same data to quantify productivity losses from misallocation in China (and India) relative to the United States. We build from the empirical approach developed in Hsieh and Klenow; however, our analysis is more disaggregated and seeks to answer a question only tangentially addressed in their paper. Whereas Hsieh and Klenow focus on the degree of misallocation across all manufacturing firms in China, we estimate the increase in misallocation within the specific industries supported by the Five Year Plan. In this sense, we provide the details, or a concrete very large example (the Five Year Plan), of how the country-wide misallocation documented by Hsieh and Klenow may result from a particular policy intervention. However, as we will explain below, we depart from Hsieh and Klenow in that we exploit the firm-level data to investigate the distributional effect of the Five Year Plan on productivity. We believe that tracing the effects out to the firm-level and mapping the cause to specific policies are important contributions. The literature has debated whether the type of country-wide comparisons used by Hsieh and Klenow (2009) really measure misallocation or instead capture other differences between countries. Our empirical strategy and results are consistent with the misallocation interpretation, lending strong support to Hsieh and Klenow (2009) [2].

To measure misallocation, we calculate revenue productivity (the product of physical productivity and a firm's output price) for each firm. In the absence of firm-level distortions, according to the theory laid out in Hsieh and Klenow (2009), revenue productivity will be equated across firms. In other words, capital and labor will be employed where their marginal value is highest. If, instead, there exists dispersion in

[2] We use the term `misallocation' as defined broadly and to include resource misallocation, as well as other sources of misallocation.

the revenue productivity across a set of firms, then this dispersion indicates the degree to which distortions are keeping capital and labor from finding their most efficient uses. These distortions mean that resources are misallocated, which lowers both total factor productivity (TFP) and the total output produced by a given set of inputs. Thus, we use the variance of total revenue productivity (the dispersion of TFPR) across firms in an industry as our primary measure of misallocation.

The data allow us to categorize firms into industries according to the Chinese National Bureau of Statistics classification codes. We use codes at the finest (4-digit) level to group firms into highly disaggregated industries and calculate the variance of TFPR in each industry. Importantly, the official documents of the 9th and the 10th Five Year Plans enable us to distinguish which 4-digit industries each plan supported. Our empirical approach, then, is to use a difference-in-difference (DID) regression model to estimate the impact on the variance of TFPR. To identify policy effects, we compare differences in the variance of TFPR between industries newly supported by the 10th Five Year Plan and those industries receiving no support in either the 9th or 10th Five Year Plan. This DID approach offers several advantages. First, it fits well with our data, which consists of repeated cross-sections rather than a panel of firms. We can directly account for observed differences across industries and over time through a series of control variables, but the DID model also allows us to net out remaining differences in misallocation between supported and not supported industries, as well as to control for the aggregate upward trend in misallocation. We interpret the resulting regression estimates as evidence that the centralized plans increased misallocation, especially for the supported industries. Our results suggest that the Five Year Plan increased misallocation by at least 6 percent and probably by much more. This large and statistically significant impact on misallocation leads us to the second part of our paper - exploring how the policies worked to increase misallocation.

We begin by showing that the average TFPR of firms in supported industries increased relative to firms in not supported industries, but average physical productivity (TFPQ) was unchanged. This finding suggests that the policies impacted average prices more than average productivity; however, both the full TFPR and TFPQ distributions changed. In other words, the average effect masks heterogeneity across firms with different levels of TFPR and / or TFPQ. To show this, we deviate from Hsieh and Klenow and employ the firm-level data (rather than aggregating to the four-digit industry level as with the DID approach) to estimate the quantile treatment effect of the Five Year Plan on the supported firms. Specifically, we estimate the non-linear difference-in-difference model, commonly known as the changes-in-changes (CIC) model proposed by Athey and Imbens (2006). This approach enables us to investigate how the policies affected the full TFPR and TFPQ distributions. The results indicate that the Five Year Plan had a positive and significant effect on most of the TFPR distribution, yet the quantile treatment effect is somewhat larger for the extreme right tail. As for the TFPQ distribution, the effect is negative and significant for the lower quintile (the least productive firms), positive and significant for the highest quintile, and insignificant for the middle quintiles. In short, while the implemented industrial policies caused the most productive firms to become more productive, firms in the extreme left tail of the distribution became even less productive. This set of results is consistent with the idea that the Five Year Plan tended to support large, low productivity firms, reducing their productivity even further.

The heterogeneous effect on the distribution of TFPR and TFPQ, thus poses the question: what mechanisms were used by the Chinese government to promote the supported industries? After all, if increased dispersion in TFPR is a result of government policies, then we should be able to relate changes in the distribution of TFPR to explicit support mechanisms used by the government. To tackle this question, we first inquire whether the 10th Five Year Plan impacted the probability that firms in the supported industries would pay taxes, receive subsidies or pay/receive interest relative to the not supported firms. We also examine whether these policies affected the ratio of taxes to value added, the ratio of subsidies to value added, and the ratio of interest payments to debt. Second, we partition the firms into three groups according to the terciles of the TFPR distribution for each four-digit industry. Splitting the firms into groups allows us to examine whether the Five Year Plan had a heterogeneous effect on the three mechanisms commonly used to support firms, while still having a large number of firms in each group. Intuitively, TFPR will increase more for firms that face larger disincentives in the form of higher taxes, worse credit conditions, or smaller subsides. Our estimation results suggest that the Chinese government doled out support to industries via direct subsidies and improved credit conditions. Moreover, the differential treatment in terms of the probability of receiving support through taxes and subsidies (as well as in the magnitude of the support) for different parts of the TFPR distribution suggest that the two mechanisms may have increased the wedge between the observed and the efficient level of TFPR and decreased aggregate TFP. As a result of the Five Year Plan, high-TFPR firms in supported industries experienced a relative increase in taxes; whereas the least productive firms received larger subsidies. The 10^{th} Five Year Plan appears to have diverted resources away from high productive firms towards low productive firms, within the supported industries.

Our results are in line with the theory and empirics from Restuccia and Rogerson (2008) who find that distortions at the firm level, stemming from tax and subsidy policies, reduce aggregate productivity. In addition to the Restuccia and Rogerson (2008) and Hsieh and Klenow (2009) papers, our work is related to several other studies on misallocation. Foster, Haltiwanger, and Syverson (2008) use revenue and physical productivity to measure firm profitability. Melitz (2003) argues that capital misallocation results in lower total factor productivity growth. Song and Wu (2015) find that capital misallocation decreases output, and Alfaro et al. (2008) find that it results in lower income. Aghion et al. (2008) find the effects of industrial policy reform are unequal across Indian states because the labor market environments differ. Guner et al. (2008) also find the effects of policies on productivity vary due to different firm characteristics. Bartelsman et al. (2010) argue that firm size affects firm productivity. Finally, Dollar and Wei (2007) find that state-owned firms in China have lower efficiency.

The paper proceeds as follows. Section 2.2 details how we use the firm-level data to measure misallocation and offers a brief overview of China's Five Year Plans. Section 2.3 discusses the empirical strategy, presents our main empirical results as well as several robustness checks. Section 2.4 investigates the effect of the Five Year Plan on average TFPR and TFPQ, tests whether the effects were heterogeneous across the TFPR and TFPQ distributions, and examines the mechanisms used to provide support. Section 2.5 concludes.

2.2 Industrial Policy, Measurement, and Data

Our regressions exploit the variation in which industries were supported by China's Five Year Plans in order to estimate the policy's effect on the misallocation of resources. In this section, we first discuss the Five Year Plans and which industries received support. We then review the theory on how to measure misallocation. Finally, we detail the firm-level information used to compute misallocation by industry.

2.2.1 China's Five Year Plans

Many countries implement industrial policies aimed at encouraging the development and growth of certain industries. In China, these policies take the form of Five Year Plans developed by the State Council (the central Communist government). The Chinese central government issued the first Five Year Plan in 1953. The objective of the earlier Five Year Plans was to establish and promote different industries by making specific investments and establishing growth objectives for each particular industry. The first Five Year Plans sought to establish a variety of industries in China during a period when the economy was centrally controlled and closed. However, since the policy of "grasping the large and letting go of the small" was enacted in 1997, a movement towards privatization has taken place. Moreover, the Five Year Plans have shifted from delineating investment and growth objectives for each industry towards establishing macroeconomic objectives and identifying particular industries to strengthen.

As mentioned in the introduction, we focus on the 10th Five Year Plan because its onset and implementation (2001-2005) are covered by the available data, which begins in 1998. The general objectives, according to the Report on the Outline of the 10th Five Year Plan for National Economic and Social Development (2001), were as follows.

First, achieve an average economic growth rate of about 7%. Second, adjust development patterns across different industries and regions, as well as between urban and rural areas. This objective required strengthening agriculture, developing the service industry, and reinforcing infrastructure. Third, increase openness and prioritize the development of science, technology, and education. Fourth, raise living standards by creating more jobs, increasing personal income, making the income distribution more equitable, and improving the social security system. Lastly, coordinate sustainable economic, social, and environmental development.

More specifically, the 10th Five Year Plan --as with all Five Year Plans-- lays out the industries (or whole sectors) to be supported over the following five years. The documentation thus allows us to match narrowly defined supported industries with the corresponding 4-digit industry code. For example, alumina manufacturing (3316), gas turbine manufacturing (3513), integrated circuit (4035), paper making (3641), and many others were specifically targeted for support. However, in several cases, the 10th Five Year Plan promotes the development of more broadly defined industries, such as ‘plastic manufacturing’. In these cases, we treat the corresponding two-digit industry as supported. Industries supported in the 10th Five Year Plan cover a large number of establishments in agricultural products processing, textile, textile products processing, leather related products manufacturing, paper and paper products, chemical products, pharmaceutical manufacturing, chemical fiber, rubber, plastic manufacturing, non-metallic mineral products, ferrous and nonferrous metal smelting, transportation and electrical equipment, communications and computers, and instrumentation manufacturing. Yet, a large number of industries such as chemicals, rubber and plastics, and motor vehicles received no support. For the sake of brevity, we refer the reader to the Appendix for a complete list of supported industries.

We conclude this section by noting that we are not able to infer all the reasons why some industries are featured in the 10th Five Year Plan from the available documentation. The stated justification is not only economic; the policies also were intended to "improve socialist, spiritual civilization, democracy and the legal system, balance reform, development and stability, accelerate development of various social undertakings, and ensure social stability". Nevertheless, our hypothesis is that the resources used for supporting firms within an industry (however these industries were selected) are not necessarily put toward their most efficient use. Specific firms may receive support to accomplish any number of objectives and especially for political expediency. Moreover, while the policy is formulated at the national level, local party officials often decide which firms to target. In particular, as we will show, there appears to be a tendency for low productivity to receive subsidies. Thus, resources may be directed to less efficient firms in supported sectors, distorting certain industries. How much the Five Year Plans worsen (or improve) misallocation is an empirical question.

2.2.2 Measuring Misallocation

We measure misallocation based on the theory developed in Hsieh and Klenow (2009). They posit that revenue productivity (TFPR), the product of physical productivity and output price, should be equal across firms in the absence of distortions. The intuition is as follows. If firms operating in the same industry have access to the same technology and face the same input (capital and labor) prices, then, in the absence of firm-level distortions, TFPR should be equalized across firms. Thus, the greater the dispersion in TFPR, the greater is the misallocation of resources [3].

Following Hsieh and Klenow (2009), we consider an environment of monopolistic competition. Each specific firm i in industry s produces differentiated output Y_{si}. Total industry output Y_s is a constant elasticity of substitution (CES) aggregate of output from the M_s firms in the industry

$$Y_s = \left(\sum_{i=1}^{M_s} Y_{si}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

where σ is the elasticity of substitution between varieties within the industry's CES

[3] The idea of using dispersion across firms to study misallocation also can be traced to Restuccia and Rogerson (2008). Foster, Haltiwanger, and Syverson (2008) first used physical productivity (TFPQ) and revenue productivity (TFPR) to study firm profitability.

aggregator. Each individual firm uses a Cobb-Douglas production technology

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}$$

where A_{si} is the firm specific technology level, K is capital, L is labor, and the capital and labor shares (α_s) are allowed to vary across industries. An individual firm's TFPR is given by

$$TFPR_{si} = P_{si} A_{si} = \frac{P_{si} Y_{si}}{K_{si}^{\alpha_s} (wL_{si})^{1-\alpha_s}} \quad (2.1)$$

where firm i sets price P_{si} and all firms face wage w. Hsieh and Klenow (2009) provide further details on the model's economic environment and for the derivation of TFPR. We also examine total factor physical productivity (TFPQ). TFPR equals P_{si} times TFPQ:

$$TFPQ_{si} = A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s} (wL_{si})^{1-\alpha_s}} \quad (2.2)$$

We take Equation (2.1) as the definition of firm specific TFPR, and we use the dispersion or variance of TFPR across firms in an industry as our measure of misallocation. Again, theoretically, there should be no dispersion in TFPR in the absence of distortions [4].

Furthermore, Hsieh and Klenow (2009) show that industry specific total factor productivity (TFPs) can be written as

$$\log TFP_s = \frac{1}{\sigma - 1} \log\left(\sum_{i=1}^{M_s} A_{si}^{\sigma-1}\right) - \frac{\sigma}{2} \operatorname{var}(\log TFPR_{si}) \quad (2.3)$$

where the summation is over the M_s firms in industry s, σ is the elasticity of substitution, and var takes the variance across the logged TFPR of firms in the industry [5].

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[4] As noted in the Introduction, the literature has suggested other factors that could impact the dispersion of TFPR, which are not captured by this model and are not necessarily misallocation. See Feng (2018), for example. However, in our empirical approach below, we rely on differential changes in the dispersion of TFPR that are unlikely to affected by any other factor other than the misallocation of resources.

[5] Technically, TFPR and TFPQ must be jointly log-normally distributed to arrive at this equation. Following Hsieh and Klenow (2009), we assume σ is the same for all sectors.

Note, the variance of TFPR is a sufficient statistic to measure the decrease in TFP due to the dispersion in TFPR. The larger an industry's TFPR dispersion, the lower the sector's aggregate total factor productivity. If resources could be reshuffled to firms with a higher marginal productivity, then the dispersion of TFPR would decrease and output would be higher. Thus, the dispersion in TFPR constitutes a suitable way to measure misallocation. Moreover, although there are many mechanisms by which misallocation could manifest itself, an increase in misallocation will result in larger dispersion in TFPR [6].

2.2.3 Data

To calculate the degree of misallocation within each industry, we use repeated cross-sections of firm-level data from the Annual Surveys of Industrial Production, which was collected by China's National Bureau of Statistics from 1998 to 2005. The survey includes non-state-owned firms with nominal revenues exceeding 5 million yuan (around $700,000) and all state-owned firms. The non-state-owned firms contain private, foreign and hybrid firms (local collectives, local government owned, etc.). The number of observations (firms) ranges from about 165,000 in 1998 to about 269,000 in 2005. The data set includes information on the firm's industry (at the 4-digit level), value-added, export revenues, capital stock, the number of employees, wage payments, ownership, age, interest payment, liabilities, and taxes paid and subsidies received.

We compute TFPR for each firm-level observation from Equation (2.1) using data on value-added, wage payments, and capital stock. Because prices, P_{si}, and non-wage compensation are not available in the survey, we follow Hsieh and Klenow (2009) and compute them as follows. First, we equate $P_{si}Y_{si}$ to the firm's value-added. Second, we define K_{si} as the book value of fixed capital net of depreciation. Third, we assume that the sum of the imputed benefits and wages --the non-wage compensation absent

[6] See Hopehayn and Rogerson (1993), Lagos (2006), Caselli and Gennaioli (2013), Buera and Shin (2009), and Guner, Ventura, and Xu (2008) for examples.

from the survey-- equals 50% of the value-added. We then map industry specific labor shares, $1-\alpha_s$, obtained from the NBER Productivity Database for the United States (based on the Census and Annual Survey of Manufacturers), into our data set [7]. After obtaining TFPR for each firm, we calculate the mean and the variance of TFPR for each 4-digit industry (separately for each year). Recall that the latter corresponds to our measure of misallocation.

To further explore how total factor productivity is affected by the 10th Five Year Plan we compute annual TFPQ for each firm i in the following manner. Given that data on firm-level output, Y_{si}, is not available from the survey, we follow Hsieh and Klenow (2009) and raise the firm's value-added, $P_{si}Y_{si}$, to the power σ/(σ-1) to obtain an estimate of Y_{si}. Replacing this estimate in Equation (2.4) we obtain

$$TFPQ_{si} = A_{si} = \frac{(P_{si}Y_{si})^{\frac{\sigma}{\sigma-1}}}{K_{si}^{\alpha_s}(wL_{si})^{1-\alpha_s}} \qquad (2.4)$$

where σ is the elasticity of substitution as defined above. Estimates of σ range from three to ten in the literature (Broda and Weinstein, 2006; Hendel and Nova, 2006). We set σ equal to three in the benchmark estimation and check the robustness of the results to using other values.

As mentioned earlier, our sample spans some --but not all-- years covered by the 9th Five Year Plan as well as the years when the 10th Five Year Plan was in place. Of the 482 four-digit industries included in the Chinese Industrial Classification code, 117 were supported by the 9th Five Year Plan. We exclude these industries from the sample in order to avoid confounding the effect of the 10th Five Year Plan with that of its predecessor. In addition, there are a few industries where the number of firms is too small to obtain a meaningful measure of misallocation. Thus, we retain only the industries that have 10 or more firms in each year. The resulting sample has a 902,175 establishments across the eight years grouped in 299 industries. Of these industries, 88 were supported by the 10th Five Year Plan. This group of industries constitutes our

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[7] Following Hsieh and Klenow (2009), we scale up the labor share by 3/2.

"treatment" group and we will refer to it as the supported group. The remaining 70% of the industries in the sample comprise our "control" or not supported group. The regressions below exploit the differential changes in the variance of TFPR across supported and not supported industries in order to estimate the impact of China's Five Year Plan on misallocation.

2.3 The Effect of Industrial Policy on Misallocation

This section provides descriptive evidence showing the effect of the 10^{th} Five Year Plan on the variance of TFPR, explicitly details our difference-in-difference regression approach, and then presents our main results.

2.3.1 Descriptive Evidence of the Impact of the 10^{th} Five Year Plan on Misallocation

The evolution of the variance of the logarithm of TFPR (var(logTFPR)) provides preliminary evidence that indicates the industrial policy leads to an increase in misallocation. Figure 2.1 plots the average var(logTFPR) for supported (solid line) and unsupported (dashed line) industries for each year in our sample. In the figure, we normalize our measure of misallocation to be 1 in 1998; the Appendix contains an un-normalized version of Figure 2.1. Both groups had similar trends in misallocation prior to the enactment of the 10^{th} Five Year Plan. Before 2001, misallocation for both groups was trending down. After 2001, misallocation increased for both groups. However, the increase was much larger for the supported industries. Relative to its nadir in 2001, misallocation in supported industries increased by 25 percent by 2005, about a 16 percent increase relative to 1998. For industries not supported by the 10^{th} Five Year Plan, misallocation increased by only 10 percent relative to 1998. This pattern suggests that the 10^{th} Five Year Plan had a differential, and very large, impact on misallocation within supported industries. Since the average var(logTFPR) increased for both groups, it is also consistent with the notion that the 10^{th} Five Year Plan increased misallocation overall.

One of the objectives of the 10^{th} Five Year Plan was to adjust development patterns across different industries. This goal suggests the possibility that the Chinese government decided to support particular industries because it prioritized industries where misallocation was greater. If this were true, then this `reverse causality' might bias our estimates and change the interpretation of our results. However, we see no evidence that industries were targeted for support based on the misallocation observed prior to the 10th Five Year Plan. Table 2.1 reports the average variance of log TFPR, the mean of TFPR, and the mean of TFPQ broken down by supported and not supported industries in 2000. The average misallocation (dispersion of TFPR) exhibited within supported industries (0.410) was almost identical to the misallocation in not supported industries (0.413). Nevertheless, the firms supported by the 10th Five Year Plan were, on average, older and less export oriented and had greater government ownership.

2.3.2 Estimation Strategy

Our difference-in-difference (DID) regression approach allows us to adjust the raw comparison in Figure 2.1 by other covariates that could affect misallocation. This estimation strategy fits well with the fact that the data used in this paper consists of repeated cross-sections of firms sampled from the same aggregate industries, s, and not of a panel of firms. Misallocation within industries selected for support could differ from those industries not selected, and the period following the 10th Five Year Plan (after 2000) could have had a different level of misallocation for all industries. The DID lets us directly control for both of these concerns. We estimate the following regression:

$$Var(\log TFPR)_{st} = \alpha_0 + \phi * Post2000_t + \eta * Supported_s + \beta(Post2000 * Supported)_{st} + X_{st}\gamma + \varepsilon_{st} \tag{2.5}$$

where $Var(\log TFPR)_{st}$ is the variance of log TFPR across firms in industry s in year t, $Post2000_t$ is a dummy variable equal to 1 if the year is after 2000, $Supported_s$ is a dummy equal to one if the industry was supported by the 10th Five Year Plan, X_{st} is a vector of covariates, and ε_{st} represents the error term.

The covariates X_{st} include variables that vary at the industry and year level: the average firm age, the average share of revenues from exports relative to value-added, and the proportion of state-owned enterprises (SOE) in the industry. The motivation for including these controls is as follows. Several studies have documented a relationship between productivity and observable characteristics of the firm such as their age and size (see, e.g. Doms, Dune and Roberts 1995; Jensen, McGuckin and Stiroh 2001). These variables are commonly used to capture differences in efficiency that stem from different levels of experience, managerial ability and production technologies. Here, because we use a measure of volatility at the industry level, we control for the average age in the industry. As for exports, empirical evidence from firm-level data suggests a positive relationship between the share of exporting firms and productivity. For instance, Wagner's (2007) survey of micro-economic studies finds that exporting firms are more productive than non-exporters and "more productive firms self-select into export markets". Hence we control for the average ratio of exports to value added in each industry, export/VA. The export/VA ratio is also intended to control for the increased participation of China in world trade [8]. Finally, starting in 1996 the Chinese government implemented a series industrial policies known as "grasping the large and letting go of the small" intended to privatize and reduce the size of the state sector. Curtis (2016) suggests that total factor productivity increased with the growth of the private sector and the closing of the least productive SOEs. Hence, the dispersion of TFPR may vary across industries depending on the share of SOEs.

The coefficients δ and η account for fixed differences in misallocation before and after 2000 and between supported and not supported industries, respectively. Thus, the coefficient β captures how being supported by the 10th Five Year Plan affects misallocation. This is the key parameter of interest. It compares $Var(\log TFPR)_{st}$, our measure of misallocation, in the supported industries, before and after the plan was put in place, with $Var(\log TFPR)_{st}$ of the not supported group over the same period. In this

[8] China joined the World Trade Organization (WTO) in 2001. However, China's government implemented policies aimed at opening the economy well in advance of joining the WTO. For example, Brandt et al. (2017) state that China's government began lowering tariff rates in 1992 and most tariff rates in the WTO accession agreement were fixed before 1999.

manner we are able to exploit cross-section and time series variation in the data while avoiding confounding the effect of the policy with that of unobserved variables that could have affected all industries at the same time.

2.3.3 Estimation Results

Table 2.2 reports the estimation results for Equation (2.5). Column (1) reports OLS estimates, with the control variables. Column (4) reports WLS estimates, also with the controls, where industries are weighted by value-added. Each regression is based on the full panel of 8 yearly observations for the 299 industries in our sample, or 2,392 observations in total. Robust standard errors clustered by industry are in parentheses.

The estimate of β (on Post2000×Supported) is statistically significant at the 10% level or better in all specifications. This represents our main empirical finding. Supported industries experienced a greater increase in misallocation than industries that were not supported by the 10^{th} Five Year Plan. We take this as strong evidence that the process used to carry out China's centralized industrial plan did not deliver more resources to the firms in which the resources could be put to their best use, at least not over the Five Year time horizon included in our analysis.

Moreover, the impact on misallocation is quantitatively large. Consider the most conservative result; in column (1), the estimate of β equals 0.026. One way to interpret this number is to look back at Table 2.1. The variance of TFPR in supported industries averaged about 0.41 in 2000. Thus, supported industries had about a 6.4 percent increase in misallocation (relative to being in the not supported group) after 2000, directly attribute to the Five Year Plan. This 6.4 percent increase accounts for a large portion of the overall increase in misallocation over time (about 25 percent in Figure 2.1) and for nearly all the difference between supported and unsupported industries.

Another way to interpret β is to look back at Equation (2.3). The increase in the variance of TFPR reduced overall TFP within supported industries. The exact magnitude of this effect depends on the parameter σ, but even at moderate values (e.g. 3), the effect is large. Both these interpretations might underestimate the true effect, though. In columns

(4) of Table 2.2, the WLS estimate for β is larger (0.058 versus 0.026). The policy appears to have had a strong impact on the misallocation of resources within large industries. Thus, the impact on the overall Chinese economy (rather than the impact for the average industry) may have been very big because the larger industries, quite obviously, make up a large share of the economy. If the 10^{th} Five Year Plan increased misallocation by 15 percent or more within the large supported industries, then this greatly reduced overall TFP growth.

It is also worth noting that misallocation went up for both supported and not supported industries over time. This pattern can be seen in Figure 2.1, and is reflected in the positive and significant estimate of δ (see Table 2.2). The coefficient estimate (η) for Supported is negative, although not statistically significant (possibly due to the fact that misallocation actually becomes larger for supported industries after 2001). In columns (1) and (4), the coefficient estimates for the other covariates have their expected sign. Older industries are more homogeneous in terms of TFPR. The coefficients of the mean of export revenues to value added are negative and significant in each specification, which indicates that industries with a higher share of export revenues to value added have less misallocation. Finally, industries with more State-Owned Enterprises exhibit much greater misallocation.

While the use of the variance of log(TFPR) to measure misallocation follows naturally from the work of Hsieh and Klenow (2009), other measures of dispersion also provide useful information regarding the effect of industrial policies. We have re-estimated Equation (2.5) using the interdecile and interquartile range as dependent variables. The estimation results reported in Columns (2), (3), (5), and (6) of Table 2.2 confirm our previous findings: industrial policies resulted in a significant increase in misallocation. Indeed, the effect appears to have been larger for firms further away in the tails of the distribution, a topic we return to shortly.

2.4 Digging Deeper into the Distributional Effects of the 10^{th} Five Year Plan

This section further explores the effect of the Chinese industrial policies on productivity and misallocation. First, we present evidence that the 10th Five Year Plan increased average TFPR for supported firms but had little or no effect on average TFPQ. Two alternative, but not mutually exclusive, explanations for the increase in misallocation (dispersion of TFPR), the increase in average TFPR, and the insignificant effect on average TFPQ are as follows. First, government policies may have had a heterogeneous effect on firms with different TFPR levels, so that the distortions introduced by the policies drove a larger wedge between the marginal products of capital and labor across firms, while leaving average productivity unaffected. Second, the support given to high- and low- productive firms might have been different. Both these possibilities have merit. We first show that the effect of the policy was heterogeneous across firms with different levels of revenue (TFPR) or physical (TFPQ) productivity. Then, we show that high- and low- productivity firms within supported industries received different levels of support. In particular, low-productivity firms in supported industries received tax breaks and direct subsidies.

2.4.1 The Effect of the 10th Five Year Plan on Average TFPR and TFPQ

The results presented in the previous section revealed that the 10th Five Year Plan increased misallocation as measured by the variance of TFPR. What was the effect of this industrial policy on the mean of TFPR and TFPQ? This section addresses this question by re-estimating Equation (2.5) where we replace the variance of TFPR with the industry mean of log TFPR. Columns (1) and (3) in Table 2.3 report the results. Again, we focus on the estimated coefficient for the interaction term $(Post2000 * Supported)_{st}$. Across all specifications, the estimate of β is positive and statistically significant at the 5% level. The 10th Five Year Plan tended to increase TFPR for firms in supported industries. These firms became more profitable relative to firms in not supported industries.

Columns (2) and (4) in Table 2.3 report the results using mean log TFPQ as the dependent variable. In these regressions, the null of no average treatment effect (β=0) cannot be rejected. Moreover, the estimated effect in quantitatively small relative to average TFPQ. We find no evidence that supported firms experienced an increase in the average physical productivity or technology level. Recall from Equations (2.1) and (2.2), TFPR equals TFPQ times price [9]. Thus, the support obtained through the 10^{th} Five Year Plan appears to have primarily increased the price that firms in supported industries charged, rather than their average productivity.

2.4.2 Heterogeneous Effects of the 10^{th} Five Year Plan

In Section 2.3.3, we described how the DID strategy uncovers significant effects of the 10^{th} Five Year Plan on misallocation. In Section 2.4.1, we showed that the 10^{th} Five Year Plan also leads to an increase in the mean of TFPR. Supported industries became more profitable on average but misallocation increased. However, the standard linear DID model recovers only the average treatment effect. Yet, the support provided by these industrial policies could be heterogeneous and depend on the pre-treatment covariates. In this section, we use the methodology developed by Athey and Imbens (2006) to estimate the quantile treatment effect for the supported firms in the difference-in-difference setting and to check whether there exists evidence of heterogeneous effects. For this approach, we use the firm-level data, rather than aggregating observations into industries.

We first use the original changes-in-changes (CIC) method proposed by Athey and Imbens (2006) to construct the counterfactual TFPR distribution that firms in the supported industries would have exhibited in the absence of the support provided by the 10^{th} Five Year Plan and compare it with the observed TFPR distribution. We do this by estimating a CIC regression without including the covariates (see Figure 2.2, Panel A). Then we follow Garlick's (2018) methodology and redo the computation controlling for the same covariates as in Section 2.3.3 (see Figure 2.2, Panel B).

The horizontal distance between the observed and the counterfactual TFPR distribution at each quantile represents the quantile treatment effect of the 10^{th} Five Year Plan on

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[9] The calculation of TFPQ depends on σ. Therefore, in the Appendix, we re-run these regressions using values of σ ranging from three to ten as a robustness check. Only at a σ value of ten does there appear to be any positive effect on TFPQ, and even then the impact is small.

firms in the supported industries. This distance, without and with adjustment for covariates, is plotted in Figure 2.3 along with the 95% confidence intervals constructed using a percentile bootstrap. Regardless of the adjustment, the point estimates are small and statistically insignificant for the lowest percentile. Yet, for the rest of the distribution the point estimates are positive and significant, albeit small (≤0.1 standard deviations). The largest point estimates are observed for TFPR percentiles that slightly exceed the median and for the extreme right tail. These results suggest that China's industrial policies lead to higher TFPR and increased misallocation because they raised revenue productivity for the highly productive firms while having no significant impact on the least productive firms.

We also compute the counterfactual TFPQ distribution for the supported firms (Figure 2.4) and estimate the quantile treatment effect on TFPQ (Figure 2.5). The point estimates are negative and significant, yet small (≤0.1 standard deviations) for the bottom quintile; positive and significant for the top quintile and insignificant for the rest of the distribution. The largest increase is observed at the extreme right tail where the point estimates exceed 0.1 standard deviations. These results reinforce our conclusion that, on average, industrial policies in China increased the price charged by supported firms but did not affect physical productivity for most of those firms. Nevertheless, significant heterogeneity in the effect on TFPQ is revealed in the graphs. The insignificant average effect of the support on TFPQ found with the difference-in-difference model masks a negative effect for the physical productivity of the least productive firms and a positive effect for more productive firms.

These results point towards three important distributional effects of the Chinese government policies. First, the 10^{th} Five Year Plan appears to have driven a larger wedge between the marginal products of capital and labor for the supported firms over most of the TFPR distribution and especially for the most productive firms. Second, the fact that these policies resulted in higher (lower) physical productivity for the supported firms in the top (bottom) quintile suggest resources were reshuffled away from high-productivity firms and toward less productive firms. Finally, for most of the supported firms (20th-80th quantile) resource productivity increased while physical productivity remained unchanged. In brief, given that TFPR=P*TFPQ, our results suggest supported firms in all but the top quintile faced greater barriers to reallocation as a result of the 10^{th} Five Year Plan.

It is important to note here that whereas the nonlinear DID model provides more information than the DID model, it requires stronger identification assumptions. More specifically, the quantile treatment effects are identified under the assumption that the distribution of the unobserved firm-level TFPR (TFPQ) determinants for supported or not supported firms does not change over time. Both the policy of "grasp the large and let go of the small" as well as the increased participation of China in world trade would suggest the distribution of the covariates might have changed over time. However, the fact that the quantile estimates are quantitatively very similar with and without controlling for covariates suggests that this is not a great concern.

Finally, Table 2.4 reports summary statistics for the observed and counterfactual TFPR and TFPQ distributions. In other words, the reports measures of TFPR (TFPQ) dispersion for the observed distribution of supported firms and the counterfactual TFPR (TFPQ) for the same firms in the absence of the support. On the one hand, the mean and variance of TFPR are somewhat higher for the observed than the counterfactual distribution, regardless of the adjustment. The support provided by the 10^{th} Five Year Plan increased the mean of TFPR by about 2% and the variance by approximately 1% for the supported firms. This is a result of the positive but small effect of the support on most quantiles of the TFPR distribution. On the other hand, the mean of TFPQ is essentially identical under the observed and under the counterfactual distribution, whereas the variance is approximately 6% higher. The support doled out by the 10^{th} Five Year Plan thus appears to have left the mean of TFPQ unchanged while increasing the dispersion of TFPQ for the supported firms. This increase in dispersion is reflective of the negative effect of the support on the lower quintile and the positive effect on the upper quintile. Our results suggest industrial policies implemented by the Chinese government resulted not only in increased misallocation but in greater dispersion on the physical productivity among supported firms.

2.4.3 Mechanism: Taxes, Subsidies or Access to Credit?

Three of the most common ways the Chinese government supports firms are tax breaks, direct subsidies, and access to credit. Each of these, when handed out to only a subset of firms, can distort the allocation of resources. The official documentation on the 10^{th} Five Year Plan does not contain information regarding the mechanism used to support firms. So, we first turn to the data to inquire about the mechanisms used by the Chinese government to provide support and then investigate whether these mechanisms had a heterogeneous impact for firms with different initial levels of revenue productivity. In other words, could a differential treatment via taxes, subsidies or access to credit explain the heterogeneous impact of the plan on the distribution of TFPR and TFPQ?

2.4.3.1 Descriptive Evidence of the Support Mechanisms

Table 2.1 reports the share of firms that paid taxes and the average tax to value-added ratio broken down by supported and not supported industries in 2000, the year prior to the 10^{th} Five Year Plan. Similarly, the also reports the share of firms in an industry that received subsidies, the average subsidy to value-added ratio, the percentage of firms that paid/received interest and the average interest to debt ratio split down by supported and not supported industries in 2000.

In 2000, the percentage of firms that paid taxes was almost identical among supported (78.41%) and not supported (77.73%) industries. The average tax to value added ratio observed among supported industries was lower (0.032) than the rate for firms in the not supported industries (0.048). In addition, while the percentage of firms that received subsidies was slightly higher among supported industries (12.02% instead of 11.02%), the average subsidy to value added ratio for the supported firms (0.0210) was almost identical to that of the not supported industries (0.0212). Differences in the ratio of interest payments to debt among supported (0.0383) and not supported (0.0397) industries in 2000 also appears to be minimal. However, in 2000, firms in the supported industries were more likely to pay/receive interest (87.5%) than firms in the not supported industries (78.67%). Since the proportion of firms that paid interest was 75%

among the former and 70.6% among the latter, these numbers suggest supported firms were somewhat more likely to receive interest payments.

2.4.3.2 A First Look into the Effects of the 10th Five Year Plan on Taxes, Subsidies and Credit Conditions

To inquire into the possible mechanisms used to support firms by the 10th Five Year Plan, we follow a two pronged approach. First, we use a Probit difference-in-difference model to estimate the effect of the plan on the probability that a firm pays taxes:

$$\Pr(Y_{ist} = 1) = \phi[\alpha + \delta Post2000_{ist} + \eta Supported_{ist} + \beta(Post2000 \times Supported)_{ist} + \varepsilon_{ist}] \quad (2.6)$$

where $Y_{ist} = 1$ if firm i in industry s paid taxes at time t. We use a similar regression to estimate the impact of the plan on the probability that a firm receives subsidies and an ordered Probit regression to model the probability of receiving or paying interest.

Second, we inquire into the effect of these industrial policies on the expected ratio of the latent taxes (subsidies) to value added, which we interpret as a proxy for the impact on the average tax (subsidy) rate faced by the supported firms. We employ a Tobit model, with the same control variables as before, to tackle this question.

Column (1) of Table 2.5 reports the estimation results for the probability of paying taxes, whereas Column (2) reports the estimation results for the Tobit. Before discussing the results, note that while the coefficient on the interaction term in the Probit/Tobit model does not equal the treatment effect, the sign of the treatment in a Probit or Tobit model does equal the sign of the interaction term (see Puhani, 2012). Thus, the positive coefficient on the interaction term Post2000×Supported suggests that the probability of paying taxes and the tax rate increased for the supported firms during the 10th Five Year Plan. At a first glance, on average, tax breaks do not appear to have been used to provide support to firms in the targeted industries.

Estimation results reported in Columns (3) and (4) of Table 2.5 suggest support was doled out in the form of subsidies. First, the 10th Five Year Plan increased the probability of receiving subsidies as well as the expected ratio of subsidies to value added. The positive sign on the interaction terms is suggestive of a positive effect of the support on the probability of paying subsidies as well as on the average ratio of subsidies to value added.

Finally, we explore the impact of the plan on the credit conditions faced by the supported firms. Column (5) reports the estimation results for an ordered Probit model where the dependent variable takes a value of zero if the firm received interest payments, one if the firm did not receive or pay interest, and two if the firm paid interest. The OLS results for the ratio of interest to debt are reported in Column (6). Our estimates suggest the 10^{th} Five Year Plan reduced the probability of paying interest for the supported firms, thus reflecting an improvement in credit conditions. However, the OLS results indicate there was no significant effect of the 10^{th} Five Year Plan on the average interest to debt ratio.

All in all, at a first glance, it would appear the 10^{th} Five Year Plan led to an increase in average subsidies and a decrease in the probability of paying interest, but also an increase in taxes.

2.4.3.3 Are All Firms Treated Equally under the 10^{th} Five Year Plan?

The results reported in the previous section are obtained under the assumption that all firms are treated equally. Yet, the fact that we find the 10^{th} Five Year Plan to have heterogeneous effects on different quantiles of the TFPR and TFPQ distributions, suggest the support mechanisms might not affect all firms equally. Recall that the CIC model indicated that the plan increased TFPR for most of the distribution; yet, the increase was somewhat greater for the extreme tail of the distribution. However, the effect on TFPQ was negative for the lower quintile and positive for the upper quintile. These results suggest an increase in the barriers faced by firms in all but the highest quintile of the distribution. Moreover, government policies appear to have led to an increase in the labor and capital wedges for the least productive firms.

To investigate whether the three key government supporting methods had unequal effects across the TFPR distribution, we partition the sample in the following manner. For each industry, we obtain the TFPR values that correspond to the 33^{rd} and 67^{th} quantiles of this pre-plan TFPR distribution. We then classify each firm-year observation into the bottom, middle, or top tier of the pre-plan TFPR distribution for its industry. We re-estimate the difference-in-difference models of the previous section on the bottom and top tier subsamples [10].

Tables 2.6 through 2.8 reproduce the estimation results for the subsamples. Three key insights are derived from these tables. First, as we noted in the previous section, the industrial policies implemented by the Chinese government increased the probability of paying taxes and the tax to value added ratio for all firms. Nevertheless, the probability of being taxed and the ratio of taxes to value added increased more for the bottom than the top tier of the pre-plan TFPR distribution (see Table 2.6). The greater effect of the policies on the least productive firms implies a greater increase in the labor and capital wedge induced by taxes on the bottom tier. In other words, while the least productive firms experienced a decline in physical productivity, the larger distortions implied by the tax policy led to heightened TFPR.

Second, whereas the least productive firms in the supported industries experienced an increase in the probability of receiving subsidies and the ratio of subsidies to value added, the effect of the 10th Five Year Plan on the most productive firms was insignificant (see Table 2.7). Support doled out via larger subsidies for the least productive firms would have implied a decrease in TFPR for this group. Third, we find some suggestive evidence indicating that the most productive firms benefited from better credit conditions whereas the plan had no significant impact for the least productive firms (see Table 2.8). Note that the sign on the interaction term in the ordered Probit model is insignificant for the bottom tier of the TFPR distribution, but negative and significant for the top tier.

We started this section by asking whether all firms were treated equally under the 10th Five Year Plan. The answer is, clearly, no. Our estimation results indicate that the least productive firms in the supported industries experienced a larger increase in the probability of paying taxes and in the ratio of taxes to value added. In addition, they also received a larger amount of subsidies (relative to their value added). In contrast,

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[10] Qualitatively, the results obtained by using the top and bottom quartile or the top and bottom quintile are identical. We opt for using tiers so as to have more representative subsamples.

firms in the top tercile faced a slight improvement in credit conditions as the probability of paying interest declined. All in all, our results suggest the unequal support provided to firms in different terciles of the distribution may explain the heterogeneity observed in the effect of the plan on the supported firms.

2.5 Key Findings

This paper explores how China's Five Year industrial policies affect the allocation of resources. Using micro-level data on manufacturing firms and a difference-in-difference approach, we find that industrial policies had important effects on misallocation. The 10^{th} Five Year Plan increased misallocation within supported industries as evidenced by the increase in the variance of TFPR and the dispersions of TFPR distribution. Moreover, the 10^{th} Five Year Plan increased profitability (mean TFPR) of supported industries, but did not increase the physical productivity (mean of TFPQ) of supported industries. By estimating a changes-in-changes model, we also find that the 10^{th} Five Year Plan had a positive and significant effect on TFPR over most of the TFPR distribution, with the effect being largest for firms with higher revenue productivity. Interestingly, the 10^{th} Five Year Plan had a highly heterogeneous effect on the physical productivity of the supported firms. TFPQ significantly declined for the least productive firms in supported industries, but it increased for high-productivity firms.

To uncover the reasons behind these results, we investigated how firms received support. Our results suggest that direct government subsidies and better credit conditions constituted the channels whereby the Five Year Plan contributed to the increase misallocation. Firms in the supported industries were more likely to receive subsidies and less likely to incur interest payments. Furthermore, we found that even firms from supported industries were treated unequally, which firms with lower TFPR from supported industries had higher probability to receive more subsidies, and firms from supported industries with the highest TFPR were less likely to pay interest.

2.6 Tables

Table 2.1: Characteristics of Supported and Non-Supported Industries

Type of Industry	Supported	Not supported
Average across industries in 2000		
$V(TFPR)$	.4103	.4130
$M(TFPR)$	1.5630	1.6335
TFPR interdecile range ($90^{th} – 10^{th}$)	1.5321	1.5623
TFPR interquartile range ($75^{th} – 25^{th}$)	.7539	.7898
$M(TFPQ)$	5.7588	5.7543
TFPQ interdecile range ($90^{th} – 10^{th}$)	2.5815	2.5609
TFPQ interquartile range ($75^{th} – 25^{th}$)	1.2760	1.3016
Age	15.535	14.248
Export/VA	.8075	1.0726
SOE share	.2317	.1975
Tax share	.7841	.7773
Tax/VA	.0320	.0486
Subsidy share	.1202	.1102
Subsidy/VA	.0210	.0212
Interest share	.8750	.7867
Interest / Debt	.0383	.0397
N (Industries)	88	211

Notes: V(TFPR) denotes the variance of log (TFPR). M(TFPR) and M(TFPQ) denote the mean values of log (TFPR) and log (TFPQ) respectively. Age is the average age of the firms in an industry. Export/VA is the average ratio of export revenue to value-added for the firms in an industry. SOE share is the percentage of state-owned firms in an industry. Interest share is the percentage of firms that received or paid interest in an industry. Interest/debt is the average ratio of interest payments to total debt across firms in an industry. Tax share is the percentage of firms that paid taxes in an industry. Tax/VA is the average ratio of taxes to value added across firms in an industry. Subsidy share is the percentage of firms that received subsidies in an industry. Subsidy/VA is the average of ratio of subsidy to value-added across firms in an industry.

Table 2.2: Effects of the 10^{th} Five Year Plan on the Dispersions of TFPR

	OLS			WLS		
Variables	V(TFPR)	90^{th} -10^{th}	75^{th} -25^{th}	V(TFPR)	90^{th} -10^{th}	75^{th} -25^{th}
	(1)	(2)	(3)	(4)	(5)	(6)
Post2000	0.0207*	0.0213	0.0117	0.0241	0.0401	0.0225
	(0.0121)	(0.0268)	(0.0144)	(0.0151)	(0.0351)	(0.0186)
Supported	-0.0144	-0.0374	-0.0313	-0.0148	-0.0344	-0.0272
	(0.0230)	(0.0534)	(0.0285)	(0.0381)	(0.0859)	(0.0456)
Post2000 × Supported	0.0264*	0.0647**	0.0398**	0.0576***	0.132***	0.0815***
	(0.0139)	(0.0314)	(0.0184)	(0.0210)	(0.0442)	(0.0250)
Mean(Age)	-0.0159***	-0.0357***	-0.0220***	-0.0142***	-0.0318***	-0.0202***
	(0.00266)	(0.00598)	(0.00313)	(0.00534)	(0.0120)	(0.00641)
Mean(Export/VA)	-0.0260***	-0.0625***	-0.0306***	-0.0385***	-0.0887***	-0.0435***
	(0.00696)	(0.0142)	(0.00748)	(0.0140)	(0.0294)	(0.0153)
Mean(SOE share)	0.467***	0.989***	0.529***	0.475**	1.039**	0.585**
	(0.101)	(0.227)	(0.117)	(0.188)	(0.424)	(0.226)
Constant	0.572***	1.936***	1.016***	0.571***	1.914***	0.998***
	(0.0357)	(0.0779)	(0.0403)	(0.0420)	(0.0955)	(0.0504)
R-squared	0.085	0.086	0.094	0.104	0.106	0.105

Notes: V(TFPR) denotes the variance of log(TFPR). (90^{th}-10^{th}) and (75^{th}-25^{th}) are the differences of TFPR between the 90^{th} and the 10^{th} percentiles and between the 75^{th} and the 25^{th} percentiles. Post2000 is the period dummy that takes the value one if the year is after 2000. Supported is a dummy that takes one if the industry is supported by the 10^{th} Five Year Plan. Mean (Age), Mean (Export/VA) and Mean (SOE share) denote the industry's average age, export/value-added and state-owned enterprise share, respectively. WLS regressions are weighted by the industry's share of value-added. The number of industry-year observations in all regressions is 2,392. Standard errors clustered at the 4-digit industry level are reported in parentheses. Statistical significance at the 1%, 5% and 10% are denoted by ***, ** and *, respectively

Table 2.3: Effects of the 10th Five Year Plan on Mean of TFPR and TFPQ

Variables	OLS		WLS	
	M(TFPR)	M(TFPQ)	M(TFPR)	M(TFPQ)
	(1)	(2)	(3)	(4)
Post2000	0.0914***	0.264***	0.249***	0.660***
	(0.0241)	(0.0481)	(0.0551)	(0.118)
Supported	-0.0579	0.0213	-0.129	-0.173
	(0.0395)	(0.0526)	(0.0818)	(0.124)
Post2000 × Supported	0.0471**	0.0355	0.102**	0.0992
	(0.0202)	(0.0266)	(0.0412)	(0.0738)
Mean(Age)	-0.0118***	-0.00718	-6.71e-06	0.0219
	(0.00445)	(0.00755)	(0.0121)	(0.0176)
Mean(Export/VA)	-0.0245***	-0.0205*	-0.0171	0.0235
	(0.00704)	(0.0108)	(0.0155)	(0.0298)
Mean(SOE share)	0.149	0.108	0.905*	2.093***
	(0.177)	(0.299)	(0.480)	(0.749)
Constant	1.783***	5.796***	1.478***	5.090***
	(0.0595)	(0.124)	(0.120)	(0.260)
R-squared	0.054	0.086	0.265	0.518

Notes: M (TFPR) and M(TFPQ) denote the mean of log(TFPR) and log(TFPQ), respectively. Post2000 is the period dummy that takes the value one if the year is after 2000. Supported is a dummy that takes one if the industry is supported by the 10th Five Year Plan. Mean (Age), Mean (Export/VA) and Mean (SOE share) denote industry's average age, export/value-added and state-owned enterprise share, respectively. WLS regressions are weighted by the industry's share of value-added. The number of industry-year observations in all regressions is 2,392. Standard errors clustered at the 4-digit industry level are reported in parentheses. Statistical significance at the 1%, 5% and 10% are denoted by ***, ** and *, respectively.

Table 2.4: Support Effects of the Five Year Plan on TFPR and TFPQ Dispersion

	Observed distribution	Counterfactual distribution	Support effect	Support effect in % terms
	(1)	(2)	(3)	(4)
	TFPR: without adjusting for covariates			
Mean	1.7250	1.6860	.0390	2.26
	(.0014)	(.0031)	(.0034)	
Variance	.4756	.4701	.0056	1.18
	(.0017)	(.0038)	(.0041)	
	TFPR: adjusting for covariates			
Mean	2.0786	2.0397	.0389	1.87
	(.0033)	(.0044)	(.0035)	
Variance	.4645	.4613	.0032	.69
	(.0018)	(.0032)	(.0036)	
	TFPQ: without adjusting for covariates			
Mean	6.0144	6.0122	.0022	.04
	(.0023)	(.0046)	(.0051)	
Variance	.9696	.9107	.0589	6.07
	(.0032)	(.0064)	(.0068)	
	TFPQ: adjusting for covariates			
Mean	5.8827	5.8821	.0006	.01
	(.0056)	(.0068)	(.0052)	
Variance	.9728	.9164	.0564	5.80
	(.0035)	(.0064)	(.0069)	

Notes: Column (1) shows the observed distribution of firms in supported industries, and column (2) shows the distribution for the same firms in the absence of support. Column (3) shows the effects of the Five Year Plan on firms from the supported industries. Column (4) shows the effect of the Five Year Plan as a percentage of the counterfactual level. Standard errors in parentheses are from 500 bootstrap iterations.

Table 2.5: Effects of the Five Year Plan on Taxes, Subsidies and Interest Payments

	Tax Dummy	Tax/Value-added	Subsidy Dummy	Subsidy/Value-added	Interest Payment	Interest/Debt
Variables	Probit	Tobit	Probit	Tobit	Ordered Probit	OLS
	(1)	(2)	(3)	(4)	(5)	(6)
Post2000	0.113***	-0.00331***	0.203***	0.185***	-0.204***	-0.00609
	(0.00454)	(0.000773)	(0.00536)	(0.00603)	(0.00399)	(0.00990)
Supported	-0.185***	-0.0309***	0.0464***	0.0393***	0.125***	-0.000441
	(0.00534)	(0.000942)	(0.00653)	(0.00731)	(0.00502)	(0.0120)
Post2000 × Supported	0.0747***	0.0135***	0.0259***	0.0297***	-.0368***	0.0153
	(0.00646)	(0.00113)	(0.00767)	(0.00860)	(0.00591)	(0.0144)
Age	0.0124***	0.000798***	0.00678***	0.00681***	0.0121***	-0.000218
	(0.000153)	(2.32e-05)	(0.000147)	(0.000163)	(0.000131)	(0.000302)
Export	-0.601***	-0.0595***	0.282***	0.224***	-0.134***	-0.0218***
	(0.00315)	(0.000582)	(0.00363)	(0.00412)	(0.00287)	(0.00727)
State-owned	-0.0548***	0.0118***	0.205***	0.257***	-0.205***	-0.0287**
	(0.00548)	(0.000890)	(0.00574)	(0.00635)	(0.00471)	(0.0115)
Cut-point 1					-1.538***	
					(0.00415)	
Cut-point 2					-0.493***	
					(0.00385)	
Sigma		0.235***		1.113***		
		(0.000201)		(0.00246)		
Constant	0.818***	0.00968***	-1.535***	-1.772***		0.0593***
	(0.00430)	(0.000733)	(0.00519)	(0.00705)		(0.0094)
Observations	902,175	902,175	902,175	902,175	902,175	902,175

Notes: The tax dummy equals 1 if a firm pays taxes, 0 otherwise. The subsidy dummy equals 1 if a firm receives subsidies, 0 otherwise. Interest Payment takes the value of 1 if the firm receives interest payments, 2 if it does not receive nor pay interests, and 2 if it pays interests. Interests/Debt is the ratio of a firm's interest payment to total liabilities. Export is a dummy that equals 1 if a firm export, 0 otherwise. State-owned is a dummy that equals to 1 if a firm is state-owned, otherwise 0. Significance levels are denoted by *** p<0.01, ** p<0.05, * p<0.1.

Table 2.6: Effects of the Five Year Plan on Tax Payments

	Bottom tier		Top tier	
	Probit	Tobit	Probit	Tobit
Variables	Tax Dummy	Tax/Value-added	Tax Dummy	Tax/Value-added
	(1)	(2)	(3)	(4)
Post2000	0.0989***	0.00186	0.0850***	-0.00690***
	(0.00784)	(0.00262)	(0.00790)	(0.000483)
Supported	-0.168***	-0.0484***	-0.202***	-0.0188***
	(0.00898)	(0.00308)	(0.00952)	(0.000609)
Post2000 × Supported	0.0871***	0.0226***	0.0448***	0.00740***
	(0.0114)	(0.00388)	(0.0111)	(0.000703)
Age	0.0162***	0.00201***	0.00811***	0.000272***
	(0.000259)	(7.51e-05)	(0.000263)	(1.53e-05)
Export Dummy	-0.724***	-0.150***	-0.476***	-0.0201***
	(0.00573)	(0.00207)	(0.00516)	(0.000345)
Ownership	0.0186**	0.0249***	-0.127***	0.00457***
	(0.00887)	(0.00276)	(0.00987)	(0.000605)
Constant	0.598***	-0.0377***	0.981***	0.0310***
	(0.00740)	(0.00248)	(0.00748)	(0.000460)
Sigma		0.435***		0.0891***
		(0.000736)		(0.000117)
Observations	252,202	252,202	368,188	368,188

Notes: Tax dummy equal to 1 if a firm pays tax, otherwise 0. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 2.7: Effects of the Five Year Plan on Subsidies

	Bottom tier		Top tier	
	Probit	Tobit	Probit	Tobit
Variables	Subsidy Dummy	Subsidy/Value-added	Subsidy Dummy	Subsidy/Value-added
	(1)	(2)	(3)	(4)
Post2000	0.199***	0.286***	0.233***	0.0610***
	(0.00910)	(0.0164)	(0.00990)	(0.00280)
Supported	0.0297***	0.0366*	0.0646***	0.0195***
	(0.0108)	(0.0193)	(0.0124)	(0.00350)
Post2000 ×	0.0725***	0.116***	-0.00991	-0.00433
Supported	(0.0132)	(0.0237)	(0.0140)	(0.00394)
Age	0.00660***	0.0106***	0.00599***	0.00161***
	(0.000248)	(0.000440)	(0.000274)	(7.69e-05)
Export Dummy	0.222***	0.259***	0.301***	0.0549***
	(0.00660)	(0.0119)	(0.00612)	(0.00176)
Ownership	0.170***	0.367***	0.225***	0.0693***
	(0.00932)	(0.0165)	(0.0109)	(0.00304)
Constant	-1.423***	-2.668***	-1.682***	-0.479***
	(0.00881)	(0.0190)	(0.00959)	(0.00340)
Sigma		1.790***		0.283***
		(0.00693)		(0.00118)
Observations	252,202	252,202	368,188	368,188

Notes: Subsidy dummy equals to 1 if a firm receives subsidy, otherwise 0. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

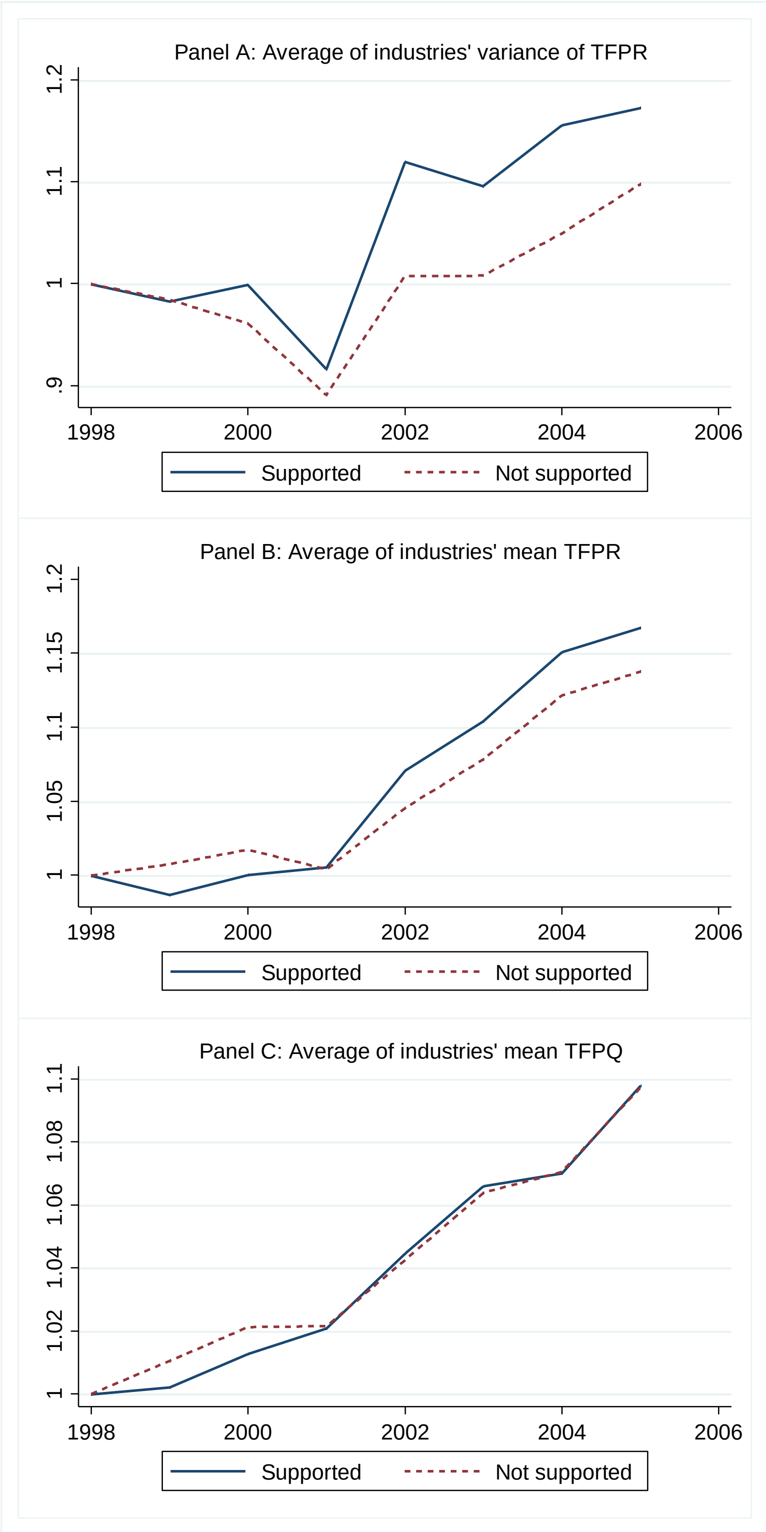
Table 2.8: Effects of the Five Year Plan on Interest Payments

	Bottom tier		Top tier	
	Ordered Probit	OLS	Ordered Probit	OLS
Variables	Interest Payments	Interest/Debt	Interest Payments	Interest/Debt
	(1)	(2)	(5)	(6)
Post2000	-0.174***	-0.00778***	-0.238***	-0.00473
	(0.00714)	(0.00285)	(0.00664)	(0.0240)
Supported	0.129***	0.000225	0.114***	9.53e-05
	(0.00869)	(0.00333)	(0.00859)	(0.0300)
Post2000 × Supported	-0.0115	0.000147	-0.0505***	0.0234
	(0.0107)	(0.00420)	(0.00975)	(0.0347)
Age	0.0119***	-4.28e-05	0.0128***	0.000129
	(0.000231)	(8.44e-05)	(0.000223)	(0.000761)
Export Dummy	-0.200***	-0.0132***	-0.116***	-0.0247
	(0.00539)	(0.00218)	(0.00451)	(0.0168)
Ownership	-0.157***	-0.0116***	-0.297***	-0.0496*
	(0.00797)	(0.00310)	(0.00823)	(0.0301)
Cut point 1	-1.449***		-1.639***	
	(0.00741)		(0.00691)	
Cut point 2	-0.507***		-0.457***	
	(0.00691)		(0.00640)	
Constant		0.0378***		0.0710***
		(0.00270)		(0.0228)
Observations	252,202	252,202	368,188	368,188

Notes: Applied interest rate is measured with firm's interest payment divided by total liability. Applied interest rate D is a dummy variable with 1, 2, and 3, corresponding to whether a firm pays negative, zero and positive interest rate. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

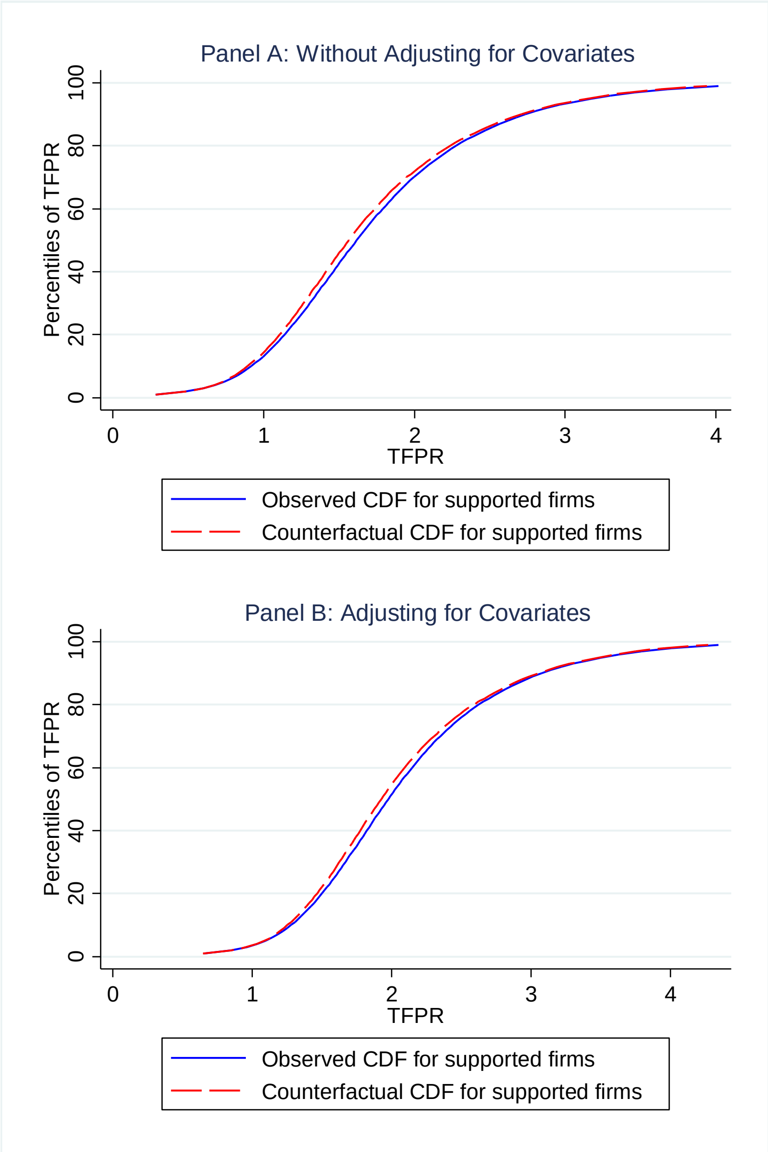
2.7 Figures

Figure 2.1: Normalized Mean or Variance of TFPR and TFPQ



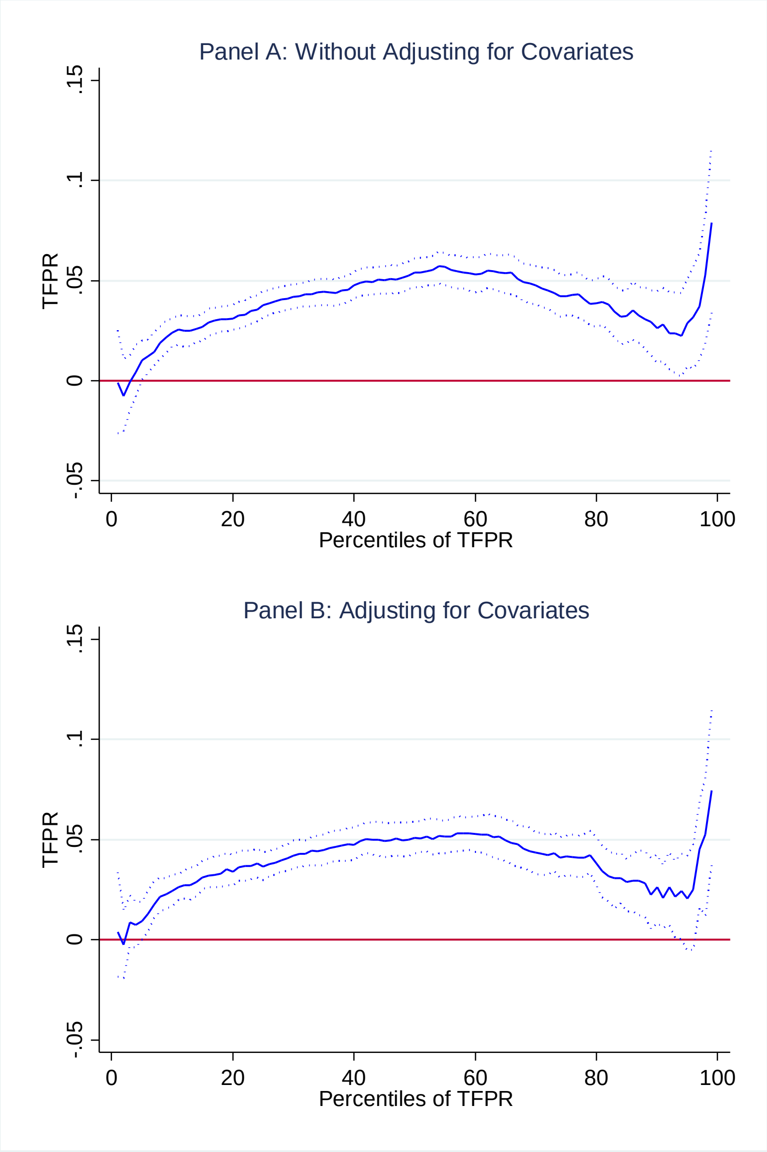
Notes: The values in 1998 for each variable is normalized to be1, and values in other years are divided by the original values in 1998 for each variable.

Figure 2.2: Quantile Treatment Effects of 10th Five Year Plan on TFPR



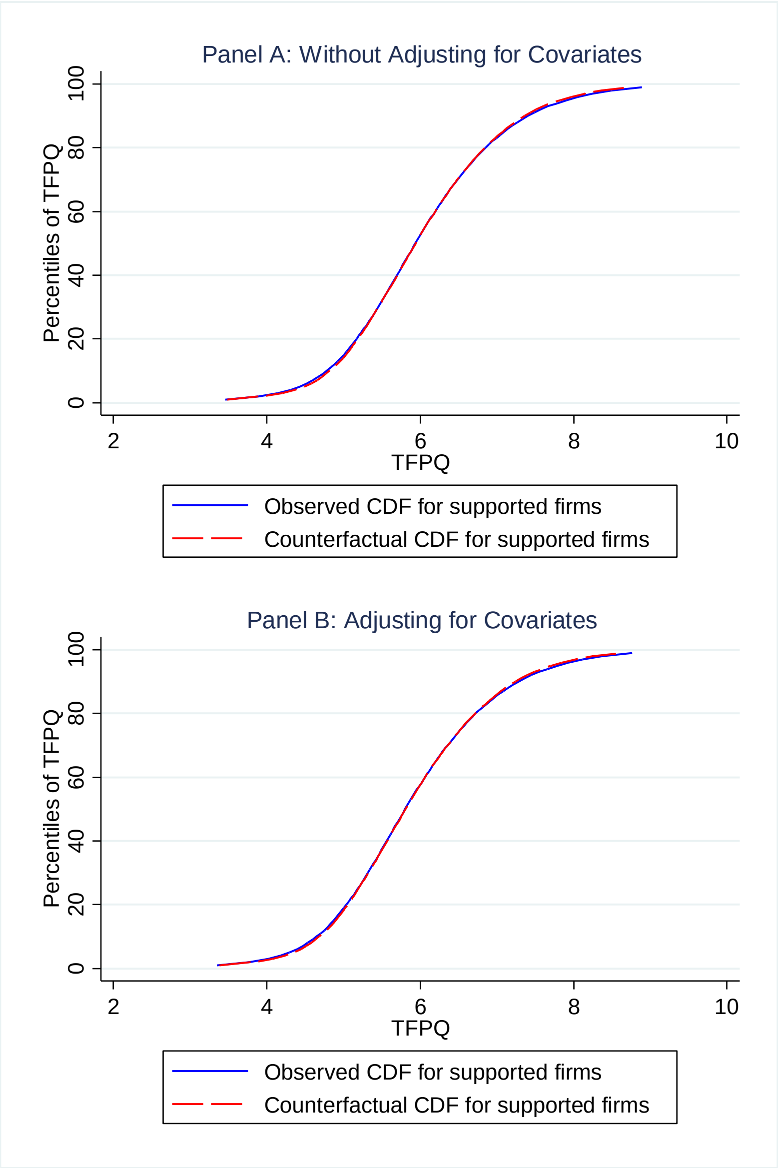
Notes: The covariates include firm's age, export dummy variable, and firm's ownership.

Figure 2.3: Quantile Treatment Effects of the 10th Five Year Plan on Supported Firms' TFPR



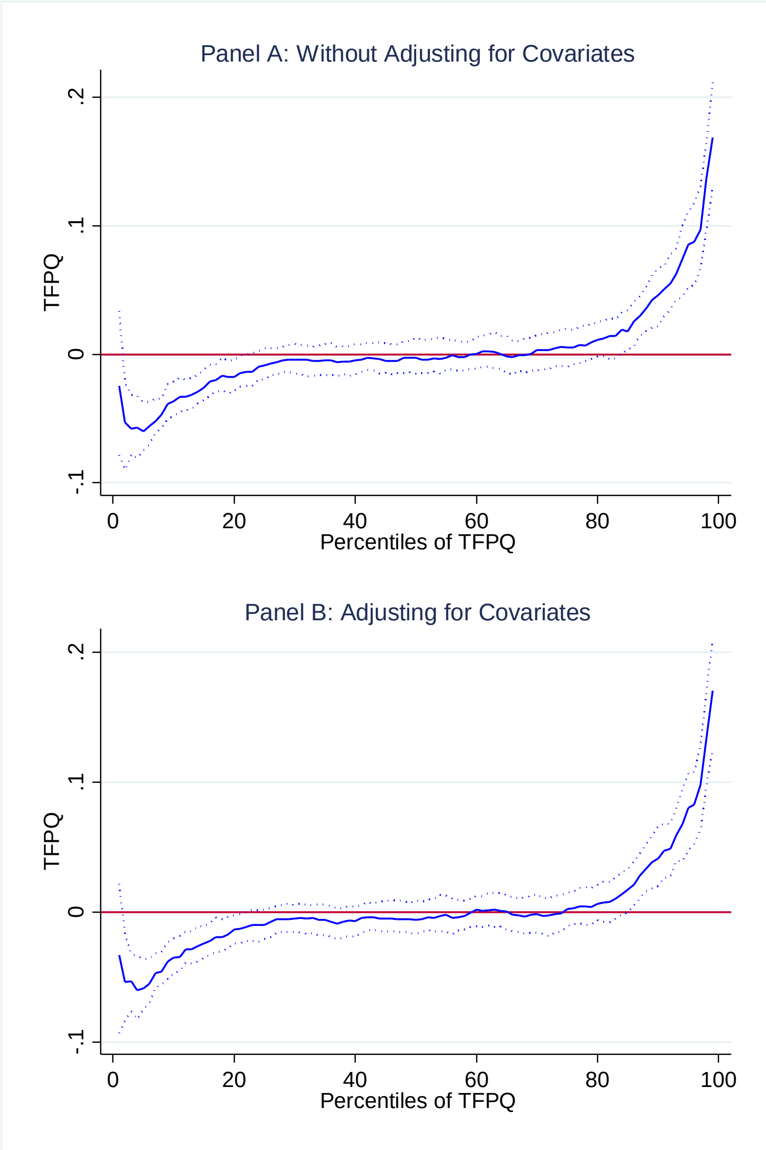
Notes: The control variables include firm's export share to value-added, age, and ownership. Solid lines denote the effects of the 10th Five Year Plan on changes at percentiles of firms' TFPR, and dash lines refer to the confidence intervals at 5% level.

Figure 2.4: Quantile Treatment Effects of the 10th Five Year Plan on Supported Firms' TFPQ



Notes: The covariates include firm's age, export dummy variable, and firm's ownership

Figure 2.5: Quantile Treatment Effects of the 10th Five Year Plan on Supported Firms' TFPR



Notes: The control variables include firm's export share to value-added, age, and ownership. Solid lines denote the effects of the 10th Five Year Plan on changes at percentiles of firms' TFPQ, and dash lines refer to the confidence intervals at 5% lev

Chapter 3 Unequal Effects of Industrial Policy

3.1 Introduction

A large and growing literature has investigated the effects of industrial policies on economic outcomes such as growth and productivity. For example, Restuccia and Rogerson (2008) examine the effects of tax and subsidies on aggregate productivity and find that policy distortions lead to decrease in output and TFP. Lewis (2004) argues policies will increase the cost of labor and will further affect productivity. Guner et al (2008) analyze that some unequal policies have different effects on firms with different sales or labor. Policies with good original intentions might bring unexpected byproducts, which might harm growth or productivity.

Policy can also influence economic activities by affecting resource allocation. Hsieh and Moretti (2015) study that housing regulations result in misallocation of individuals across US metropolitan areas, and further contribute to a loss in aggregate GDP. Pro-state-owned enterprises policies in China hinder resources allocation between state-owned and other firms in China, which result in productivity losses of Chinese manufacturing industries. (Song, Storesletten, and Zilibotti (2011)) Due to different characteristics of firms and industries across provinces, policies might have heterogeneous effects on them.

Using Chinese manufacturing firm-level data, I examine whether there are unequal effects of the most important industrial policy in China –the Five Year Plan-on misallocation, profitability and real technology. Following Hsieh and Klenow (2009), I compute firm's revenue productivity (TFPR) and physical productivity (TFPQ) to measure profitability and real technology, respectively. Misallocation is measured by the variance of TFPR for an industry. Larger variance of firm's revenue productivity of an industry will lower the industry's aggregate total factor productivity (Hsieh and Klenow, 2009).

The Five Year Plan is made by the central government to guide economic and investment activities to support specific industries in the following five years. Local governments are the executors of the Five Year Plans. However, local governments might support industries differently due to different economic status of the supported industries. For example, if the supported industries in one province are considered to be pillar industries, but not in another province, they might receive different support from local governments. Therefore, industrial policies may result in unequal effects across regions.

As targeted firms and industries in different provinces might receive different support, I use the share of value-added of supported industries in a province to denote supporting intensity in that province. Higher supporting intensities are found in less developed provinces in western China, whereas more developed provinces in the eastern coasts have lower supporting intensities before the issuing of the 10^{th} Five Year Plan. However, some provinces experience an increase in supporting intensity, some exhibit decrease, and some others show no significant trends once the Five Year Plan is enacted.

I find that the Five Year Plan increased misallocation in the supported industries in provinces with higher value-added share of supported industries, consistent with Chen et al (2018). Moreover, the Five Year Plan improved average profitability and real technology of industries in provinces with higher supporting intensities. To address potential concerns that the Five Year Plan might capture effects of other macro events in China, I control for state-owned enterprise reforms and joining the World Trade Organization of China. The effects of the Five Year Plan still remain after including these controls.

3.2 Five Year Plan and Supporting Intensity

3.2.1 The Five Year Plan

The most important and widely influential industrial policy in China is the Five Year Plan, which has been enacted by the central government every five years since the establishment of the People's Republic of China [11]. The main goals of the Five Year Plans are to guide investment and economic activities in the following five years. For example, the aim of the first Five Year Plan issued in 1953 was to guide investment into the establishment of multiple industries in most provinces and districts. Every Five Year Plan lists the industries that are going to be supported in the following five years, and industries which are considered to be important for national defense like metal smelting are supported for most of the Five Year Plans.

Local governments are the executors of the Five Year Plans. After the issue of the Five Year Plan by the central government, local governments like provincial, district, and county make regional plans to support the industries mentioned in the Five Year Plans by the central government. Local governments take all kinds of measures to support these industries, because the development of these industries is one of the important indicators for officers' promotion.

3.2.2 The 10^{th} Five Year Plan

I study the effects of the 10^{th} Five Year Plan on misallocation, profitability and technology. The reason to focus on the 10^{th} Five Year Plan is that firm-level data is only available from 1998-2005. The 9^{th} and the 10^{th} Five Year Plans span from 1996-2000 and 2001 to 2005, respectively. Therefore, the available data allows me to examine the effects of the 10^{th} Five Year Plan. Moreover, the data are from the Annual Surveys of Industrial Production conducted by the Chinese National Bureau of Statistics. The surveys contain information such as firm's age, wages, subsidies, industry, location, value-added, tax payments, book value of net depreciation, etc. Based on the official documents of the Five Year Plans and firm's industry information in the data set, I can identify the 4-digit level industries that are supported by the 9^{th} or the 10^{th} Five Year Plans.

Like most of the recent Five Year Plans, the 10^{th} Five Year Plan by the central government lists the name of supported industries in the official document. Therefore,

[11] Most of the Five Year Plans were issued every five years since 1953, except there are 3 years gap between the second and the third Five Year Plans.

with this information, I am able to match the supported industries in the Five Year Plan to the industries and firms in the data set. However, Chinese National Bureau of Statistics used different Chinese Industrial Classifications (CIC) codes to classify industries before and after 2002. The first step is to match the CIC codes of the years 1998-2001 with those of 2002-2005, even though there are only a small portion of industries that changed their codes number. I use the industrial codes of 2002-2005 to recode those in 1998-2001. The next step is to match the industries supported by either the 9th or 10th Five Year Plans to the 4-digit level industries in the data set. I match the date sets by hand for accuracy. After matching, supported industries can be identified, and all firms inside the supported industries are also treated as in the supported group.

After matching, there are 194 industries supported by the 10th Five Year Plan out of the total 482 four-digit industries. Moreover, 89 of the supported industries are supported by both the 9th and the 10th Five Year Plans, and 105 of the supported industries are supported by the 10th Five Year Plan only. Specifically, around 53% firms are in the industries supported by the 10th Five Year Plan, and around 33.4% firms are supported by the 10th Five Year Plan only.

A natural question to ask is: why are these industries are supported by the 10th Five Year Plan? From the official documents of the 10th Five Year Plan, the aims to support these industries are to restructure industries and to enhance international competitiveness. Industries like raw materials manufacturing and textiles manufacturing are encouraged to restructure by increasing products variety, improving quality, reducing energy use and pollution, using more advanced technology, etc. Moreover, hi-tech industries such as computer equipment, airplane manufacturing, and optoelectronic materials manufacturing should adopt the world frontier technology to be more internationally competitive.

As an industry or a firm can be supported by both the 9th Five Year Plan, it brings interference to identify the effects of the 10th Five Year Plan on industries' outcomes. Therefore, in order to identify the effects of the 10th Five Year Plan on misallocation, profitability and technology, I need to eliminate the effects of the 9th Five Year Plan to avoid over-estimation of the effects of the 10th Five Year Plan. As mentioned above, the available data ranges from 1998 to 2005, which covers the last three years of the 9th Five Year Plan period and the whole five years of the 10th Five Year Plan period. Therefore, industries can be divided into four groups by whether they are supported by the 9th or the 10th Five Year Plans. These four groups of industries are: (1) supported by the 9th Five Year Plan only, (2) supported by the 10th Five Year Plan only, (3) supported by both the 9th and the 10th Five Year Plans and (4) not supported by neither the 9th nor the 10th Five Year Plans.

Only groups (2) and (4) are kept in the date set to identify the effects of the 10th Five Year Plan. The Five Year Plans could potentially affect misallocation of supported industries. Therefore, if industries supported by the 9th Five Year Plan are included in the sample, the estimates could be biased. I exclude industries supported by the 9th Five Year Plan to avoid these compounding effects.

3.2.3 Supporting Intensity

As executors of the Five Year Plan, local governments might support the targeting industries differently. The importance of the supported industries for the local economy might affect the governments' supporting strength. For example, if the supported industries happen to be considered pillar industries and contribute most of the value-added for a province or district, local governments could provide more support to those industries.

As industries might obtain difference support, I use the ratio of value-added of supported industries to that of all industries in a province to measure supporting intensity. Higher supporting intensity does not guarantee that the target industries will obtain more support. Figure 3.1 shows support intensities in different provinces in different years. Panel A and B show supporting intensities in provinces before the issue of the 10th Five Year Plan. Surprisingly, less developed provinces in the middle and western regions have higher supporting intensity. Provinces in the eastern coast have relatively lower intensities. After the issue of the 10th Five Year Plan in 2001, a few provinces move to tiers with higher level of intensity, but there are also some provinces that move to groups with lower level of intensity from 2000 to 2001. By the end of the 10^{th} Five Year Plan in 2005, more provinces have lower levels of intensities, which is also surprising because supported industries should have higher value-added share after receiving support from local governments.

Besides the geographical difference of supporting intensity among provinces, Figure 3.2 shows the change of value-added share for each province from 1998-2005. The supporting intensities in provinces such as Hainan, Xizang, and Ningxia Hui, increased after the issue of the 10^{th} Five Year Plan. However, the supporting intensities of provinces like Beijing, Hubei, Jiangxi and Xinjiang, decreased drastically, and the intensity of some other provinces dropped slightly.

Several possible reasons can explain why supported industries have lower value-added shares in 2005 than 2001. First of all, compared with supported industries, there might be more firms and faster development in not supported industries. Secondly, the Five Year Plan could have had an opposite effect on the value-added of supported industries to the original aim. For example, if most of the support is given to firms with lower productivities, the overall growth rate of the supported industries will lag behind. Moreover, if local governments choose to support those largest state-owned firms, a decrease in competition could lead industries to have lower output.

3.3 Regional Misallocation and Productivities

3.3.1 Measurement of Misallocation, Profitability and Technology

I follow Foster et.al (2008), and Hsieh and Klenow (2009) to measure profitability, technology and misallocation for firms and industries. Foster et.al (2008) first propose to use revenue total factor productivity (TFPR) and physical productivity (TFPQ) to measure profitability and technology, respectively. Subsequently, Hsieh and Klenow (2009) suggest that the larger of the variance of TFPR in an industry, the larger of misallocation within that industry. Following Foster et. al (2008) and Hsieh and Klenow (2009), I compute the revenue productivity and physical productivity as below:

$$TFPR_{si} = P_{si}A_{si} = \frac{P_{si}Y_{si}}{K_{si}^{\alpha_s}(wL_{si})^{1-\alpha_s}} \tag{3.1}$$

$$TFPQ_{si} = A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s}(wL_{si})^{1-\alpha_s}} \tag{3.2}$$

where $TFPR_{si}$ refers to the profitability (revenue productivity) of firm i in industry s, and $TFPQ_{si}$ denotes the technology (physical productivity) of firm i in sector s. P_{si}, Y_{si} and $P_{si}Y_{si}$ are the output price, output quantity and value-added of firm i in industry s, respectively. Moreover, A_{si} measures firm's technological level, which is also TFPQ, K_{si} is the capital input of firm i in industry s, and wL_{si} measures firm's aggregate labor input. In addition, for sector s, α_s is the marginal product to capital, and $1-\alpha_s$ the marginal product to labor. Therefore, TFPR measures productivity of unit value-added to capital and labor input, and TFPQ measures productivity of unit quantity to capital and labor input.

However, TFPQ values cannot be computed directly from the firms' information in the data, therefore, I follow Hsieh and Klenow (2009) to compute TFPQ by raising $P_{si}Y_{si}$ to the power $\sigma/(\sigma-1)$ to get Y_{si}. TFPQ can be obtained by using the following expression:

$$TFPQ_{si} = A_{si} = \frac{(P_{si}Y_{si})^{\frac{\sigma}{\sigma-1}}}{K_{si}^{\alpha_s}(wL_{si})^{1-\alpha_s}} \tag{3.3}$$

where σ is the elasticity of substitution between firm value-added, and its value ranges from three to ten (Broda and Weinstein, 2006, Hendel and Nova, 2006).

After the computation of TFPR and TFPQ for each firm, the mean of TFPR and TPFQ and the variance of TFPR in sector s in province p can also be obtained, which I use them to measure profitability, technology and misallocation in industry s in province p . In addition, the reason why misallocation could be measured by the variance of TFPR is given in Hsieh and Klenow (2009), as is shown in (3.4).

$$\log TFP_s = \frac{1}{\sigma - 1}\log(\sum_{i=1}^{M_s} A_{si}^{\sigma-1}) - \frac{\sigma}{2}\operatorname{var}(\log TFPR_{si}) \tag{3.4}$$

As there are no computed labor and capital shares for Chinese manufacturing industries, I follow Hsieh and Klenow (2009) and use those in American manufacturing industries to measure labor and capital shares. Therefore, before computing TFPR and TFPQ values for Chinese firms, the Chinese Industrial Classification (CIC) code should be matched with American Standard Industrial Classification (SIC) code, so as to obtain the values of labor share ($1-\alpha$) for different Chinese industries. The classifications of industries in SIC and CIC are similar to each other, but there are also some small differences. If one industry in SIC is corresponding to several industries in CIC, all these industries in CIC will be given the value of labor share in SIC. However, if one industry in CIC is corresponding to several industries in SIC, this industry in CIC will be assign the average value of labor shares of the corresponding industries in SIC. For example, a 4-digit industry with code “1310” in CIC is corresponding to two industries of “2041” and “2044” in SIC. If the ($1-\alpha$) values for “2041” and “2044” were 0.2 and 0.4 respectively in 2001, the ($1-\alpha$) value of industry 1310 in CIC will be given 0.3 (average of 0.2 and 0.4) in 2001. After obtaining the values of labor share for each industry in Chinese manufacturing, I still follow Hsieh and Klenow (2009) to compute labor share by scaling up 3/2 to ($1-\alpha$), and then obtain the firm-level TFPR and TFPQ values. Therefore, regional misallocation in a specific industry can be obtained by taking variance of firm’s TFPR within the industry and region, and average profitability and technology can be obtained by computing the mean of industry’s TFPR and TFPQ in a region in any given year.

3.3.2 Quantifying Misallocation across Regions

Figure 3.3 shows misallocation across provinces. As Panel A illustrates, misallocation is measured by the average of variance of manufacturing industries in a given province in 1998. Panel A and B show misallocation before the issue of the Five Year Plan in 1998 and 2000. The three northeastern provinces and some provinces in middle China have the most serious misallocation, and there is less misallocation in the more developed eastern provinces and less developed western provinces. Panel C shows misallocation in 2001, when the Five Year Plan was issued; there is no apparent difference in misallocation between 2001 and 2000. However, misallocation in 2005 in Panel D is more severe than before. There are more provinces with higher levels of misallocation, especially provinces in the middle and northeastern in China. Surprisingly, there are still lower levels of misallocation in more developed eastern coastal provinces.

Figure 3.4 shows the evolution of misallocation in each province over the years. Consistent with the above description, more developed provinces such as Shanghai, Jiangsu and Zhejiang, experienced lower levels of misallocation both before and after the Five Year Plan. Some provinces such as Tianjin and Henan, had lower levels of misallocation, but increasing in variance of TFPR after 2001. Provinces like Sichuan and Xinjiang, have a descending trend in misallocation before the Five Year Plan, but upward trend after the Five Year Plan. And some other provinces such as Qinghai and Ningxia, experienced more fluctuations in misallocations during the period. Overall, there are increases in misallocation in most provinces after the Five Year Plan.

3.3.3 Endogeneity of the Five Year Plan

There are two concerns about the endogeneity of the issue of the 10th Five Year Plan. The first one is reverse causality. If the Five Year Plan was issued because the central government expected that there was misallocation, profitability and technology problems in the supported industries, there would be reverse causality from the Five Year Plan to the outcomes of interest.

The presence of reverse causality is not likely. The official document of the 10th Five Year Plan states that the reason to support these industries is to optimize industry structure and to make them more competitive with foreign firms. For example, the central government encourages some industries like computer equipment manufacturing and biotechnology engineering by helping them to use the new advanced technology of the world.

Moreover, Chen et al (2018) show statistical evidence that there are little concerns of endogeneity of the issue of the Five Year Plan on misallocation, revenue and physical productivity. The distributions of variance and mean values of TFPR and TFPQ before the issue of the Five Year Plan, show no evidence that central government only supports industries that are experiencing high misallocation, or lower profitability and technology There is no evidence to indicate that central government expected there would be misallocations, profitability and technology problems in these supported industries in the future.

The second concern of endogeneity is that some unobserved variables might be correlated with the issue of the Five Year Plan. The relationship between unobserved variables and the issue of the Five Year Plan is untestable. Therefore, Chen et al (2018) examine whether there are significant differences between supported and not supported industries by groups of observed variables. They find that there are industries with both most and least number of employees, with both most and least number of firms, and with both large-sized and small-sized firms in both supported and not supported industries.

3.4 Empirical Analysis

3.4.1 Method

Following Aghion et. al (2008), I start with the following specification,

$$Y_{spt} = \lambda_{sp} + \lambda_{pt} + \lambda_{st} + \beta[(Fiveyearplan)_{st} \times (Intensity)_{pt}] + \varepsilon_{spt} \quad (3.5)$$

where Y_{spt} is a (logged) 4-digit province-industry outcome variable in each year. The dependent variables are variance of TFPR, mean of TFPR and mean of TFPQ, which measure misallocation, average revenue productivity and physical productivity, respectively. $(Fiveyearplan)_{st}$ is the interaction of a time dummy and an industry dummy. The time dummy variable equals to 1 if an industry or a firm is in the Five Year Plan period, and 0 otherwise. And the industry dummy equals to 1 if an industry of a firm is in the supported group, and 0 otherwise. $(Intensity)_{pt}$ refers to the ratio of total value-added of supported industries to the total of value-added of all industries in province p in year t. λ_{sp} are province-industry interactions, λ_{pt} are province-year interactions, and λ_{st} are industry-year interactions. ε_{spt} is a stochastic error.

I am interested in the coefficient of the interaction of the Five Year Plan and value-added intensity β, which captures the effects of the 10th Five Year Plan on resource allocation and productivities of different industries.

3.4.2 Results

To examine the average effect of the 10th Five Year Plan on misallocation for different provinces, I first consider a model without the interactions in column (1) to (4) in Table 3.1. The results in column (1) show the average effects of the Five Year Plan on misallocation across provinces. The positive and significant coefficient indicates that the 10th Five Year Plan brought more misallocation to industries that were supported by the industrial policy than those than were not supported. Even after the standard errors are clustered at province level in column (2), the coefficient of the interaction of the Five Year Plan is still positive and significant. As the 10th Five Year Plan was issued at the same time for all provinces, I cluster standard errors only at provincial level.

To investigate how large is the effect of the Five Year Plan on misallocation, I use the methodology of Hsieh and Klenow (2009) to compute the effect. For example, in columns (3) and (4), the coefficients of the interaction are both 0.12, which indicates that there will be 18% larger misallocation in supported industries than not supported ones. This effect is quite large compared with those estimated in Chen et al (2018), where misallocation is measured at industry and year level. One possible explanation why larger effects of the 10th Five Year Plan on misallocation are found is that provinces with less number of firms and less aggregate value-added usually exhibit a rapid growth in variance of TFPR after the Five Year Plan.

Columns (5) and (6) examine the effects of the 10th Five Year Plan on misallocation of provinces with different supporting intensities. The estimation results reported in column (5) correspond to a model that includes province-year, industry-year and province-industry fixed effects. The results reveal a positive and significant effect of the industrial policy on misallocation across provinces and industries. The coefficient on the interaction indicates that 10% increase in the ratio of intensity will improve misallocation by 3% among supported industries. After clustering the standard errors by province, the coefficient in column (6) is still positive and significant.

As the 10th Five Year Plan increases misallocation measured by variance of TFPR across provinces with different intensities, it changes dispersions of firm’s TFPR of supported industries. The next natural question to ask is whether the Five Year Plan changes the average values of TFPR and TFPQ? Table 3.2 shows the effects of the 10th Five Year Plan on revenue productivity of industries in provinces with different intensities. Columns (1) and (2) examine the effects of the industrial policy on industry’s average revenue productivity without and with clustering, respectively. The positive and significant coefficients on the interaction indicate that the Five Year Plan increases supported industry’s average revenue productivity. As revenue productivity measures profitability, the Five Year Plan increases supported industries’ average profitability.

Intensity is controlled in the models reported in columns (3) and (4). Coefficients of the Five Year Plan are still positive and significant, but the magnitude drops by half relative to those in columns (1) and (2). The coefficients on intensity are positive and significant, indicating that the Five Year Plan improves average profitability of supported industries in provinces with higher value-added shares of supported industries. Columns (5) and (6) examine the effects of the Five Year Plan and intensity on industry’s average revenue productivity, which the positive and significant coefficients show that the larger of intensity in a given province, the larger effects of the Five Year Plan on increasing average revenue productivity of industries in the province.

The effects of the 10th Five Year Plan on physical productivity are shown in Table 3.3. Columns (1) and (2) examine the effects of the industrial policy on industry’s physical productivity across provinces without and with clustering at province, respectively. The positive and significant coefficients show that the Five Year Plan increases real productivity of supported industries at the provincial level. However, Chen et al (2018) find no significant effects of the 10^{th} Five Year Plan on physical productivity measured by 4-digit industry level. The reason for the difference with Chen et al (2018) might be that differences in the effect of the plan on TFPQ across provinces disappear when the data is aggregated across provinces.

After adding value-added intensity into the model, as is shown in columns (3) and (4), the coefficients of intensity are positive, which indicates that the higher proportion of value-added in supported industries of all industries in a certain province, the higher of average real technology level of industries in the province. Moreover, the coefficients of the Five Year Plan are still positive and significant. Columns (5) and (6) present the results of the interactions of the Five Year Plan and supporting intensity on industry's physical productivity, which the models include province-year, industry-year and province- industry interactions. The interaction coefficients are still positive, indicating that for provinces with higher intensities of the supported industries, the Five Year Plan increased the technology level of the supported industries more.

The estimation results reveal that the 10^{th} Five Year Plan had different effects on misallocation, revenue productivity and physical productivity on provinces with different intensities. In provinces with higher proportion of value-added of supported industries, there increase in misallocation, average profitability, and technology levels in the province, brought by the Five Year Plan was greater.

3.4.3 Concerns about Effects of the Five Year Plan on Intensity

One potential concern is that province intensities respond to changes in industry mix following the 10^{th} Five Year Plan. To control for this, I use variables of intensity at 1998 and 2000 respectively to measure intensity in other years. The year 1998 is the earliest year in the sample, and 2000 is the year before the 10^{th} Five Year Plan was enacted. The results using intensity at 1998 and 2000 are shown in Table 3.4.

Columns (1) and (2), which include the Five Year Plan and intensity at 1998 variables, show the coefficients remain positive and significant, indicating that the higher intensity at 1998 of an industry in a given province, the more misallocation will be in the supported industry of the province after the 10^{th} Five Year Plan. Columns (3) and (4) present the effects of the interaction of the Five Year Plan and value-added intensity at 1998 on misallocation, and the coefficients are still positive and significant, indicating that industries in provinces with higher proportion of value-added in 1998 in supported industries will have more misallocation during the 10^{th} Five Year Plan period. I also check the effects of interaction of the Five Year Plan with intensity at 2000. The results are presented in columns (5) to (8). The coefficients remain positive and significant. Both the coefficients of the interactions between the Five Year Plan and value-added intensities in the pre-policy years are similar in magnitude to those of the interactions between the Five Year Plan and value-added intensity in each year.

Table 3.5 presents the results of the interactions between the Five Year Plan and intensities of pre-policy years on industry's average revenue productivity and physical productivity. The coefficients remain positive and significant, indicating that the higher proportion of value-added in supported industries to all industries in years before the Five Year Plan in a given province, the higher profitability and technology levels of the industry in such province in the following years. Therefore, the pre-policy cross-province variation in intensity will affect how industries respond to the Five Year Plans in the following years.

3.4.4 SOE Reform and WTO Joining

Another potential concern is that the effects of the Five Year Plan might capture the effects of state-owned-enterprises (SOE) reforms on outcomes. There have been reforms for state-owned-enterprises since the Reform and Opening Policy in China. The main content of reforms is to establish modern enterprise system in SOE, promote the shareholding system in SOE, and introduce capital from private, foreign entities, etc. Columns (1) to (4) in Table 3.6 examine the effects of SOE reforms on misallocation together with the Five Year Plan. Columns (1) and (2) report the estimation results for a model that adds the variable of value-added share of SOE for all firms within the industry. The coefficients of SOE share are not significant, which is consistent with Hsieh and Klenow (2009). However, the coefficients of Five Year Plan and intensity remain positive and significant. Columns (3) and (4) include the interaction of SOE share and intensity, but their coefficients remain insignificant. The coefficients of the interactions between the Five Year Plan and intensity are still positive and significant, indicating that the Five Year Plan does not capture the effects of SOE reforms in affecting misallocation.

China joined the World Trade Organization (WTO) in November, 2001, during the period of the 10th Five Year Plan. Forming part of the WTO made it potentially easier for firms to export their products. Easier access to export might change the distribution of firm's productivity, because exporting could make firms more productive. As there is an overlap between the period spanning the 10th Five Year Plan and the period post joining the WTO, the Five Year Plan might capture the effects of joining the WTO on misallocation and productivities.

Thus, changes in TFPR and TFPQ of exporting firms might be driven by the international demand shocks. Therefore, I introduce the ratio of value-added in exporting firms to that of all firms within the industry to control for the effect of joining the WTO. Columns (5) to (8) in Table 3.6 present the effects of the Five Year Plan and joining into WTO on industry's misallocation. The coefficients of the Five Year Plan and intensity in columns (5) and (6) remain positive and significant, and the coefficients on the share of exporting firms' value-added are negative and significant, which indicates that the higher share of value-added of exporting firms for an industry, the less misallocation within the industry. In columns (7) and (8), I keep the interactions of the Five Year Plan and intensity, and of the value-added share of exporting firms and intensity, and the results show that the Five Year Plan still increases misallocation in industries in provinces with higher supporting intensity, and the higher value-added share of export firms of an industry is, the less misallocation in that industry.

Moreover, columns (9) and (10) aim to control for the effects of the SOE reforms and joining the WTO together with the Five Year Plan. The results are consistent with the previous findings. That is, the Five Year Plan increased misallocation among industries in provinces with higher intensity, joining the WTO decreased misallocation of industries with more exporting firms, and SOE reforms had an insignificant influence on industries' misallocation.

Table 3.7 also examines the effects of the Five Year Plan together with SOE reforms and joining the WTO on industries' average TFPR and TFPQ. Columns (1) and (2) present the effects of the Five Year Plan and SOE reforms with value-added intensity on sectors' average profitability. The coefficients measuring the effects of the Five Year Plan are still positive and significant, and the coefficient measuring the effects of SOE reforms in column (2) is negative and significant, indicating that the higher share of SOE of an industry, the less profitability of the industry has. Results in columns (3) and (4) indicate that the Five Year Plan increases industry's average profitability, and joining the WTO also increases industry's average profitability.

Columns (5) and (6) present the effects of the Five Year Plan and SOE reforms on industry's average technology level. The positive and significant coefficients to measure the effects of the Five Year Plan indicate that the plan increases supported industry's technology level. The positive and significant coefficient of SOE share indicates that the higher share of SOE in an industry, the higher level of the average technology of the industry. Columns (7) and (8) present the effects of the Five Year Plan and joining the WTO on industry's average technology level, and results show that the Five Year Plan increases industry's average technology level, but the effect of joining the WTO has insignificant influence on industry's technology level.

3.4.5 Other Robustness Checks

The ratio of intensity of supported industries in all industries might also be correlated with misallocation, profitability and technology levels of industries in a given province. Therefore, I construct a dummy to distinguish whether an industry is in the top, middle or bottom tercile of the cross-province distribution of misallocation, profitability and technology for a given year. I then interact the middle and bottom terciles with the Five

Year Plan omitting the top tercile as a control group, and Table 3.8 shows the effects of the Five Year Plan interacting with different terciles on the variance or mean of TFPR and TFPQ.

Column (1) presents the coefficient to measure the effect of the Five Year Plan remains positive, indicating the Five Year Plan increases misallocation. The coefficients of the interactions with middle and bottom terciles are both negative, indicating that being in the middle and bottom terciles is associated with less misallocation relative to the top tercile. Results in columns (2) and (3) indicate that the Five Year Plan increases profitability and technology levels of sectors in provinces with higher ratio of intensity, but being in the middle and bottom are associated with a smaller increase in profitability and technology levels relative to the top tercile.

3.5 Key Findings

The question of how would industrial policy affect industry's behavior was examined. Using the 10th Five Year Plan as testing ground, I computed variables to measure misallocation, profitability and technology for industries with firm level data, and then tested the effects of the most important industrial policy in China-the Five Year Plan-on industries' outcomes.

The main finding is that the Five Year Plan had unequal effects on provinces with different supporting intensities. Consistent with Hsieh and Klenow (2009), and Chen et al (2018), I found misallocation existing across Chinese manufacturing industries. But the effects varied in provinces with different proportions of supported industries. Specifically, the 10th Five Year Plan increased misallocation of industries in provinces with higher value-added share of supported industries. Among industries that were supported by the 10th Five Year Plan, if value-added share of supported industries increased by 10%, misallocation caused by the Five Year Plan would increase by 3%. Moreover, the Five Year Plan also increased average profitability and technology levels of industries in provinces with higher value-added share of supported industries.

As the Five Year Plan might change the supporting intensities, I use supporting intensity at the year of 1998 and 2000 as dependent variables to conduct the robustness check. I found that industries in provinces with original higher value-added share of supported industries had larger misallocation, higher profitability and technology levels. Moreover, the SOE reforms and joining the WTO might also affect firms' and industries' productivities, therefore, I also checked the effects of SOE reforms and joining the WTO together with the Five Year Plan, and still found consistent conclusions that the Five Year Plan increased misallocation, profitability and technology levels of supported industries. Compare with industries in top tercile of misallocation, profitability and technology levels respectively, I found that industries in the middle and bottom experienced less misallocation, lower profitability and lower technology increase.

3.6 Tables

Table 3.1: Effects of the Five Year Plan on the Variance of TFPR

Variables	(1) Variance (TFPR)	(2) Variance (TFPR)	(3) Variance (TFPR)	(4) Variance (TFPR)	(5) Variance (TFPR)	(6) Variance (TFPR)
Five Year Plan	0.161***	0.161***	0.120***	0.120***		
	(0.0124)	(0.0296)	(0.0122)	(0.0132)		
Intensity			0.0229***	0.0229***		
			(0.000618)	(0.00229)		
Five Year Plan×Intensity					0.00333***	0.00333***
					(0.000398)	(0.000563)
N	44,110	44,110	44,110	44,110	44,110	44,110
R-squared	0.435	0.435	0.452	0.452	0.481	0.481
Year Fixed Effects	Yes	Yes	Yes	Yes	No	No
Province Fixed Effects	Yes	Yes	Yes	Yes	No	No
Sector Fixed Effects	Yes	Yes	Yes	Yes	No	No
Year×Province Fixed Effects	No	No	No	No	Yes	Yes
Year×Sector Fixed Effects	No	No	No	No	Yes	Yes
Sector×Province Fixed Effects	No	No	No	No	Yes	Yes
Cluster at province	No	Yes	No	Yes	No	Yes

Note: Variance (TFPR) is measured at 4-digit industry level for a given province. *** p<0.01, ** p<0.05, * p<0.1

Table 3.2: Effects of the Five Year Plan on the Mean of TFPR

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Mean (TFPR)	Mean (TFPR)	Mean (TFPR)	Mean (TFPR)	Mean (TFPR)	Mean (TFPR)
Five Year Plan	0.148***	0.148***	0.0762***	0.0762***		
	(0.00892)	(0.0471)	(0.00825)	(0.0123)		
Intensity			0.0414***	0.0414***		
			(0.000416)	(0.00463)		
Five Year Plan×Intensity					0.00142***	0.00142***
					(0.000258)	(0.000403)
N	55,283	55,283	55,283	55,283	55,283	55,283
R-squared	0.889	0.889	0.906	0.906	0.915	0.915
Year Fixed Effects	Yes	Yes	Yes	Yes	No	No
Province Fixed Effects	Yes	Yes	Yes	Yes	No	No
Sector Fixed Effects	Yes	Yes	Yes	Yes	No	No
Year×Province Fixed Effects	No	No	No	No	Yes	Yes
Year×Sector Fixed Effects	No	No	No	No	Yes	Yes
Sector×Province Fixed Effects	No	No	No	No	Yes	Yes
Cluster at province	No	Yes	No	Yes	No	Yes

Note: Mean (TFPR) is measured at 4-digit industry level for a given province. *** p<0.01, ** p<0.05, * p<0.1

Table 3.3: Effects of the Five Year Plan on the Mean of TFPQ

Variables	(1) Mean (TFPQ)	(2) Mean (TFPQ)	(3) Mean (TFPQ)	(4) Mean (TFPQ)	(5) Mean (TFPQ)	(6) Mean (TFPQ)
Five Year Plan	0.365*** (0.0167)	0.365** (0.145)	0.143*** (0.0128)	0.143*** (0.0228)		
Intensity			0.109*** (0.000543)	0.109*** (0.0125)		
Five Year Plan×Intensity					0.00327*** (0.000507)	0.00327*** (0.000369)
N	55,317	55,317	55,317	55,317	55,317	55,317
R-squared	0.965	0.965	0.980	0.980	0.984	0.984
Year Fixed Effects	Yes	Yes	Yes	Yes	No	No
Province Fixed Effects	Yes	Yes	Yes	Yes	No	No
Sector Fixed Effects	Yes	Yes	Yes	Yes	No	No
Year×Province Fixed Effects	No	No	No	No	Yes	Yes
Year×Sector Fixed Effects	No	No	No	No	Yes	Yes
Sector×Province Fixed Effects	No	No	No	No	Yes	Yes
Cluster at province	No	Yes	No	Yes	No	Yes

Note: Mean (TFPQ) is measured at 4-digit industry level for a given province. *** p<0.01, ** p<0.05, * p<0.1

Table 3.4: Effects of the Five Year Plan on the Variance of TFPR

Variables	(1) V (TFPR)	(2) V (TFPR)	(3) V (TFPR)	(4) V (TFPR)	(5) V (TFPR)	(6) V (TFPR)	(7) V (TFPR)	(8) V (TFPR)
Five Year Plan	0.110***	0.110***			0.110***	0.110***		
	(0.0122)	(0.0127)			(0.0122)	(0.0127)		
1998 Intensity	0.0258***	0.0258***						
	(0.000609)	(0.000878)						
2000 Intensity					0.0291***	0.0291***		
					(0.000685)	(0.000987)		
Five Year Plan× 1998 Intensity			0.00317***	0.00317***				
			(0.000373)	(0.000517)				
Five Year Plan× 2000 Intensity							0.00324***	0.00324***
							(0.000373)	(0.000515)
N	44,110	44,110	44,110	44,110	44,110	44,110	44,110	44,110
R-squared	0.457	0.457	0.481	0.481	0.457	0.457	0.481	0.481
Year Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No
Province Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No
Sector Fixed Effects	Yes	Yes	No	No	Yes	Yes	No	No
Year×Province FE	No	No	Yes	Yes	No	No	Yes	Yes
Year×Sector FE	No	No	Yes	Yes	No	No	Yes	Yes
Sector×Province FE	No	No	Yes	Yes	No	No	Yes	Yes
Cluster at province	No	Yes	No	Yes	No	Yes	No	Yes

Note: V(TFPR) refers to the variance of TFPR at 4-digit industry level in a province. *** p<0.01, ** p<0.05, * p<0.1

Table 3.5: Effects of the Five Year Plan on the Mean of TFPR and TFPQ

Variables	(1) M (TFPR)	(2) M (TFPR)	(3) M (TFPQ)	(4) M (TFPQ)
Five Year Plan× 1998 Intensity	0.00129***		0.00303***	
	(0.000365)		(0.000460)	
Five Year Plan× 2000 Intensity		0.00130***		0.00311***
		(0.000378)		(0.000461)
N	55,283	55,283	55,317	55,317
R-squared	0.915	0.915	0.984	0.984
Year Fixed Effects	No	No	No	No
Province Fixed Effects	No	No	No	No
Sector Fixed Effects	No	No	No	No
Year×Province FE	Yes	Yes	Yes	Yes
Year×Sector FE	Yes	Yes	Yes	Yes
Sector×Province FE	Yes	Yes	Yes	Yes
Cluster at province	No	Yes	No	Yes

Note: M(TFPR) and M(TFPQ) refer to the mean of TFPR and TFPQ at 4-digit industry level in a province, respectively. *** p<0.01, ** p<0.05, * p<0.1

Table 3.6: Effects of the Five Year Plan on the Variance of TFPR

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Five Year Plan	.119***	.119***			.117***	.117***			.116***	
	(.0123)	(.0131)			(.0123)	(.0131)			(.0130)	
Value-added Intensity	.0226***	.0226***			.0231***	.0231***			.0229***	
	(.00066)	(.0021)			(.00062)	(.00232)			(.00212)	
Five Year Plan × Intensity			.00336***	.00336***			.00319***	.00319***		.00324***
			(.00040)	(.00056)			(.00040)	(.00056)		(.000557)
State-owned share	.0424	.0424							.0213	
	(.0296)	(.0525)							(.0546)	
Exporting share					-.0191***	-.0191***			-.0182**	
					(.00573)	(.00682)			(.00712)	
State-owned share × Intensity			-.000846	-.000846						-.00166
			(.000766)	(.00144)						(.00160)
Exporting share × Intensity							-.00052***	-.00052***		-.00060***
							(.00014)	(.00016)		(.000197)
N	44,110	44,110	44,110	44,110	44,110	44,110	44,110	44,110	44,110	44,110
R-squared	0.452	0.452	0.481	0.481	0.452	0.452	0.481	0.481	0.452	0.481
Year FE	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No
Province FE	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No
Sector FE	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No
Year×Province FE	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes
Year×Sector FE	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes
Sector×Province FE	No	No	Yes	Yes	No	No	Yes	Yes	No	Yes

Note: Standard errors are clustered at province level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.7: Effects of the Five Year Plan on the Mean of TFPR and TFPQ

Variables	(1) M (TFPR)	(2) M (TFPR)	(3) M (TFPR)	(4) M (TFPR)	(5) M (TFPQ)	(6) M (TFPQ)	(7) M (TFPQ)	(8) M (TFPQ)
Five Year Plan	0.0790***		0.0795***		0.132***		0.144***	
	(0.0122)		(0.0123)		(0.0202)		(0.0230)	
Value-added Intensity	0.0420***		0.0412***		0.107***		0.109***	
	(0.00460)		(0.00459)		(0.0121)		(0.0125)	
Five Year Plan×Intensity		0.00165***		0.00150***		0.00321***		0.00319***
		(0.000417)		(0.000391)		(0.000494)		(0.000487)
State-owned share	-0.0888				0.387***			
	(0.0598)				(0.110)			
Exporting share			0.0204***				0.00892	
			(0.00467)				(0.00889)	
State-owned share × VA Intensity		-0.00577***				0.00165		
		(0.00153)				(0.00378)		
Exporting share× Intensity				0.000329***				-0.000315
				(0.000115)				(0.000276)
N	55,283	55,283	55,283	55,283	55,317	55,317	55,317	55,317
R-squared	0.906	0.915	0.906	0.915	0.980	0.984	0.980	0.984
Year FE	Yes	No	Yes	No	Yes	No	Yes	No
Province FE	Yes	No	Yes	No	Yes	No	Yes	No
Sector FE	Yes	No	Yes	No	Yes	No	Yes	No
Year×Province FE	No	Yes	No	Yes	No	Yes	No	Yes
Year×Sector FE	No	Yes	No	Yes	No	Yes	No	Yes
Sector×Province FE	No	Yes	No	Yes	No	Yes	No	Yes

Note: M(TFPR) and M(TFPQ) refer to the mean of TFPR and TFPQ, respectively. Standard errors are clustered at province level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.8: Effects of the Five Year Plan on the Variance or Mean of TFPR and TFPQ

	(1)	(2)	(3)
Variables	V (TFPR)	M (TFPR)	M (TFPQ)
Five Year Plan×Intensity	0.0141***	0.0121***	0.0174***
	(0.000880)	(0.000613)	(0.00107)
Five Year Plan×Middle Tercile	-0.692***	-0.516***	-0.685***
	(0.0309)	(0.0197)	(0.0244)
Five Year Plan×Bottom Tercile	-0.924***	-0.971***	-1.399***
	(0.0351)	(0.0321)	(0.0448)
N	44,110	55,283	55,317
R-squared	0.506	0.923	0.986
Year×Province FE	Yes	Yes	Yes
Year×Sector FE	Yes	Yes	Yes
Sector×Province FE	Yes	Yes	Yes
Cluster at Province	Yes	Yes	Yes

Note: V(TFPR), M(TFPR) and M(TFPQ) refer to the variance of TFPR, mean TFPR and TFPQ at 4-digit industry level in a province, respectively. *** p<0.01, ** p<0.05, * p<0.1

Figure 3.1 Panel A: Value-added of Supported Firms to that of All Firms in 1998

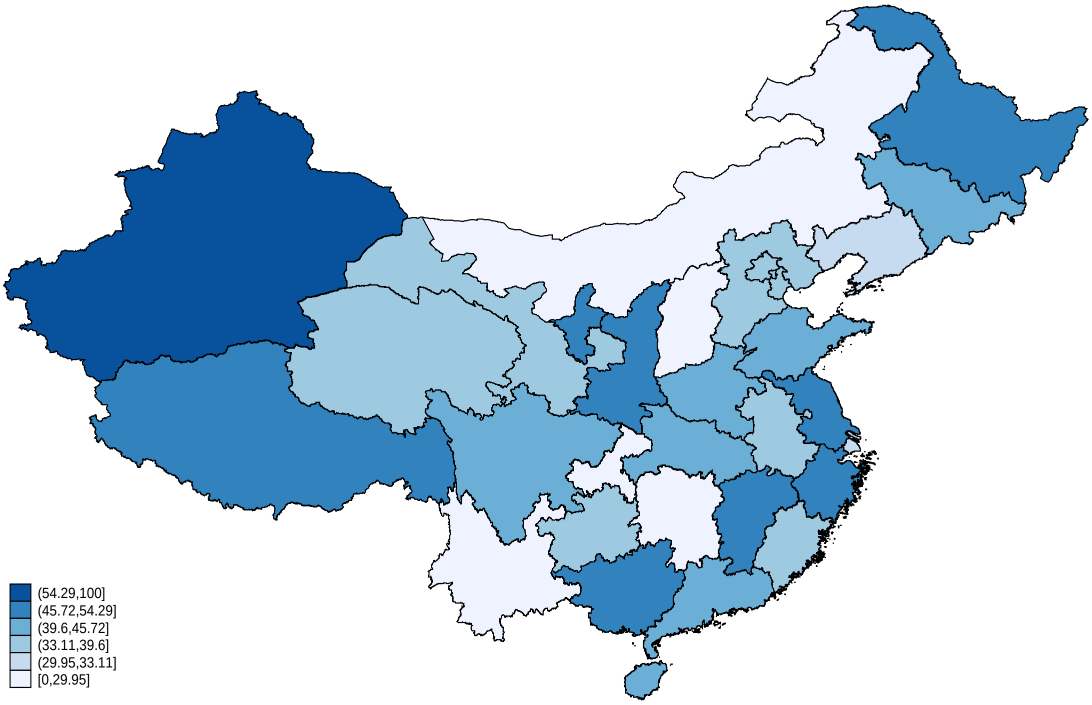


Figure 3.1 Panel B: Value-added of Supported Firms to that of All Firms in 2000

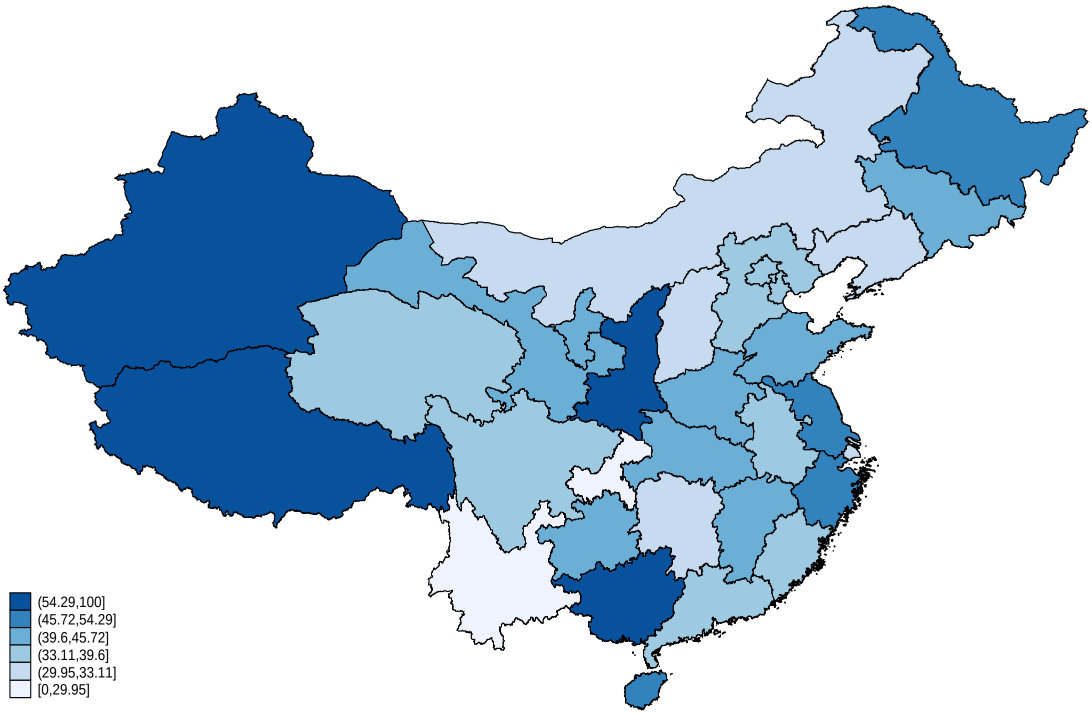


Figure 3.1 Panel C: Value-added of Supported Firms to that of All Firms in 2001

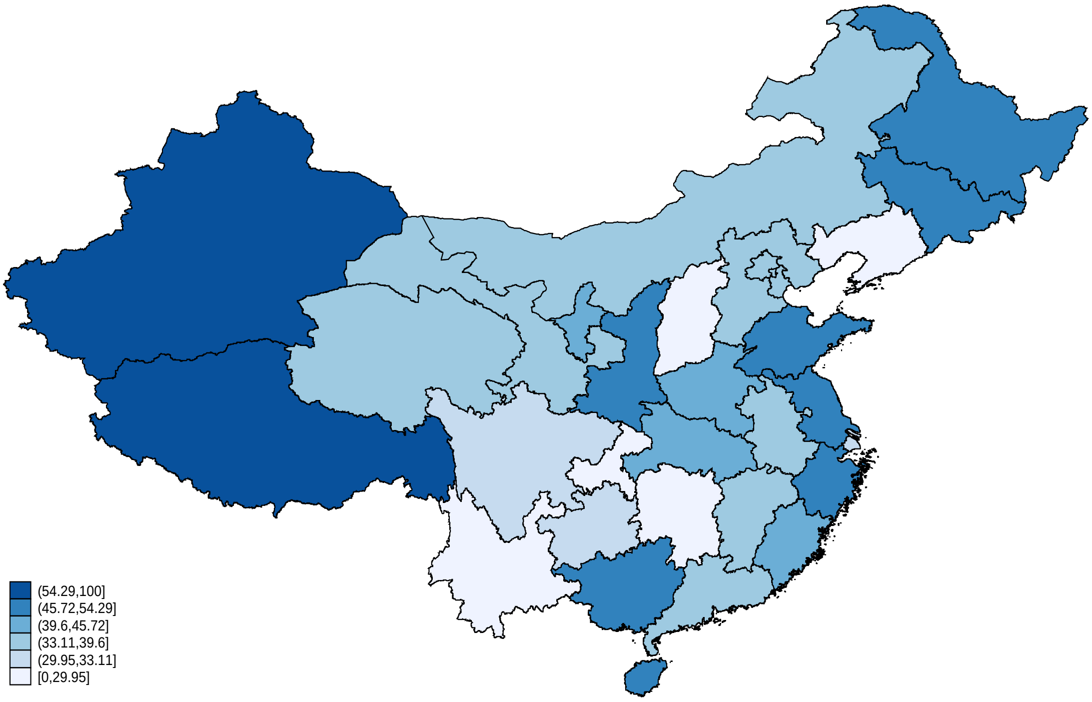


Figure 3.1 Panel B: Value-added of Supported Firms to that of All Firms in 2005

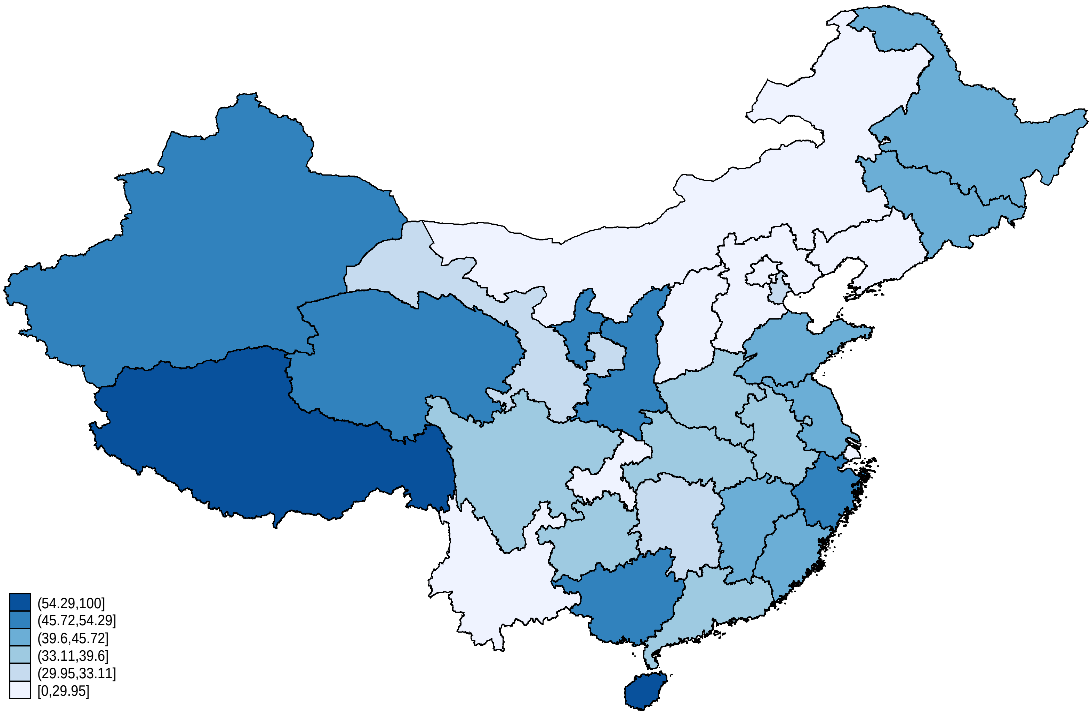


Figure 3.2: Supporting Intensity across Provinces

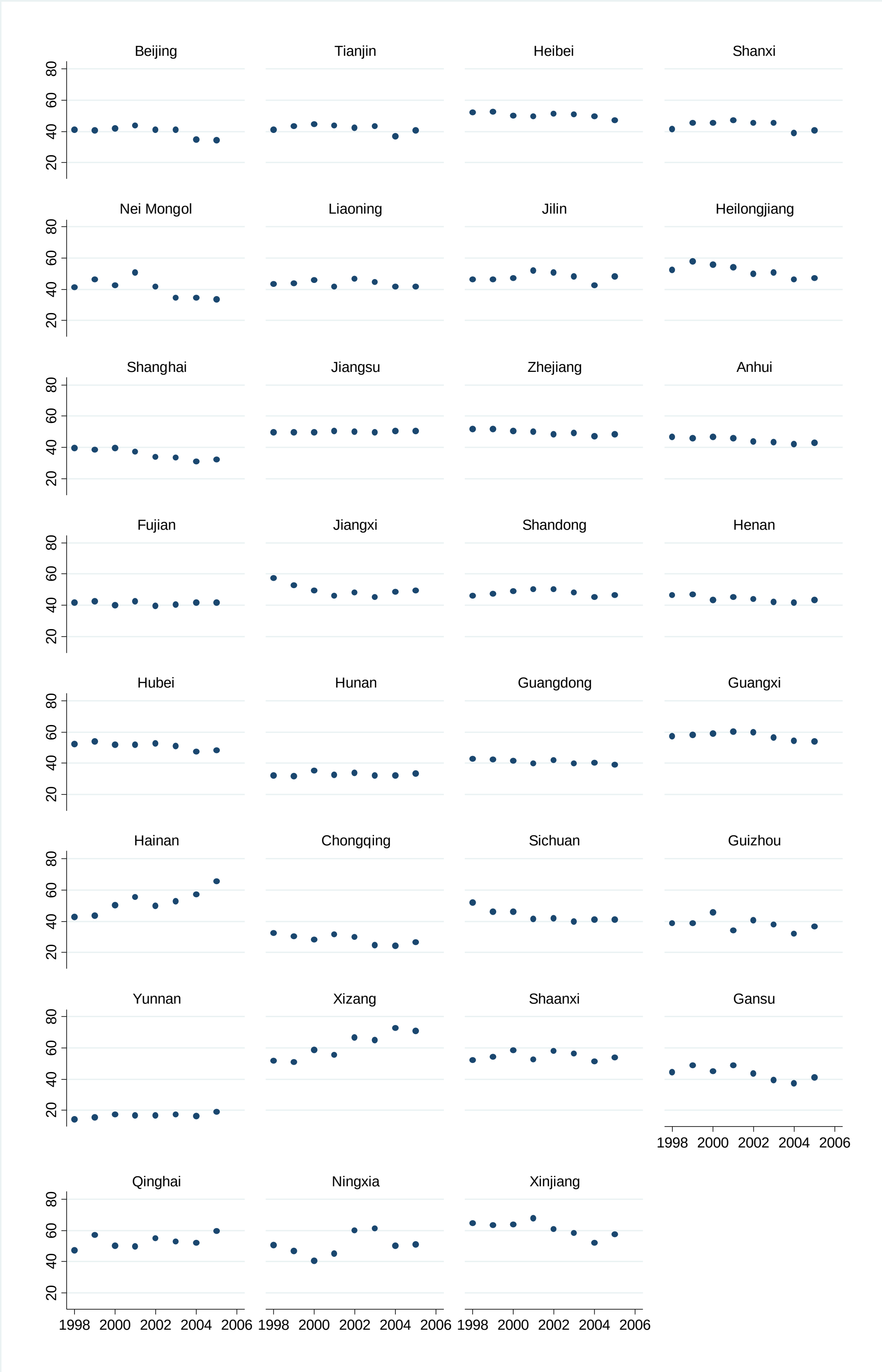


Figure 3.3 Panel A: Misallocation in 1998

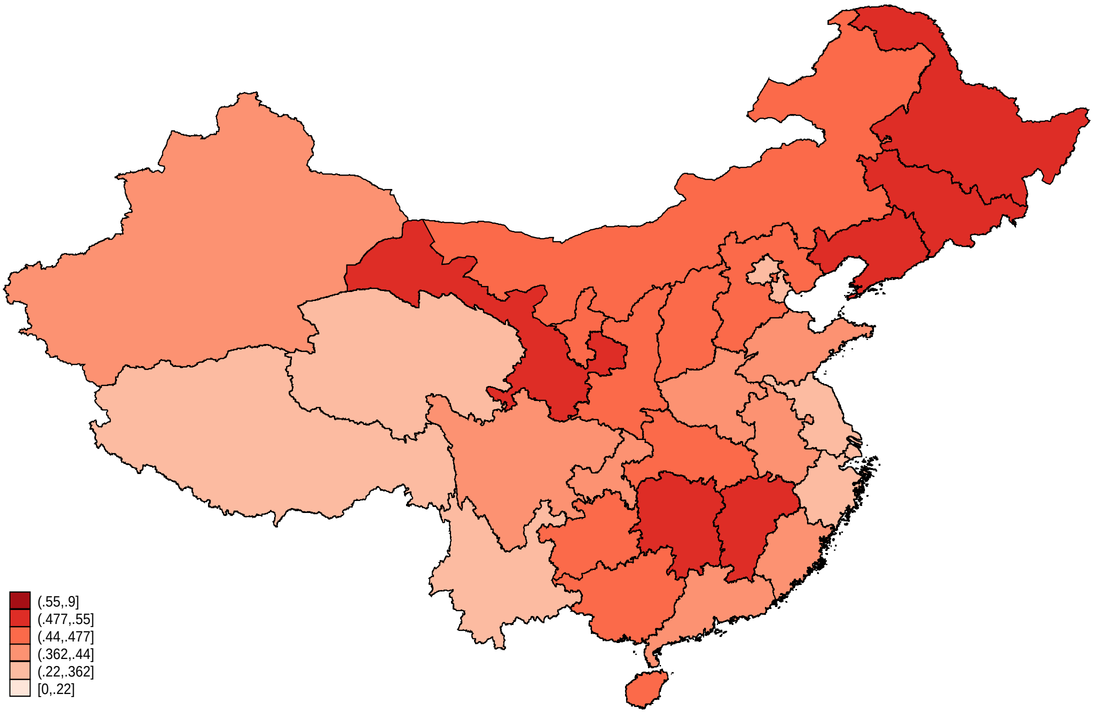


Figure 3.3 Panel B: Misallocation in 2000

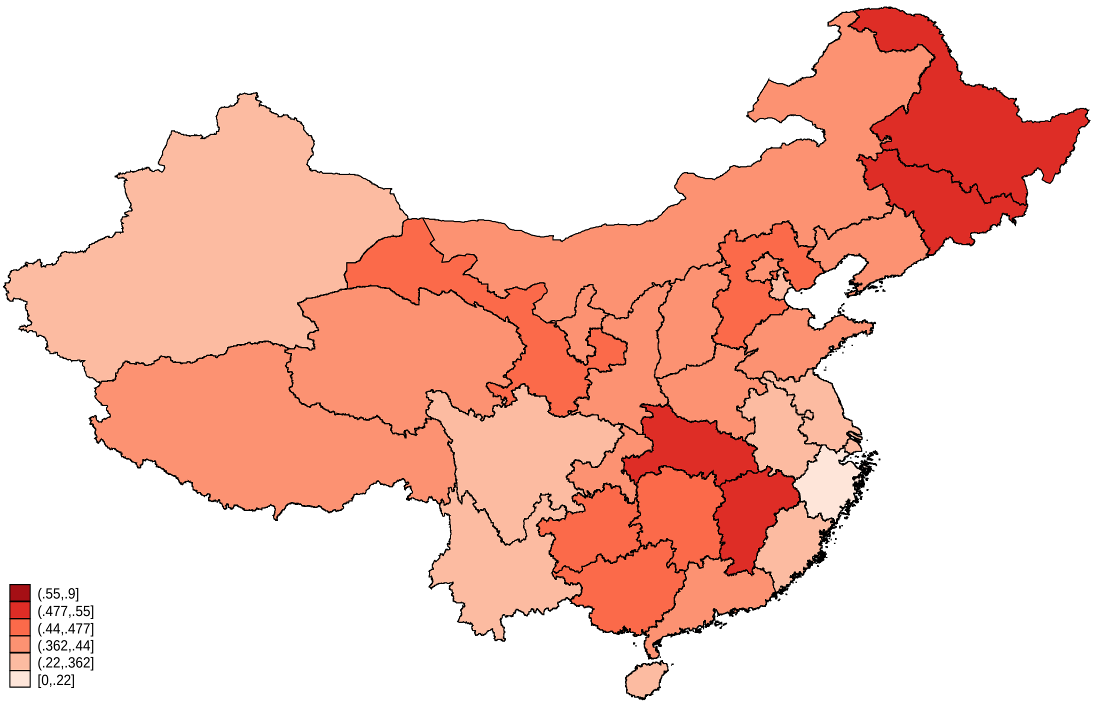


Figure 3.3 Panel C: Misallocation in 2001

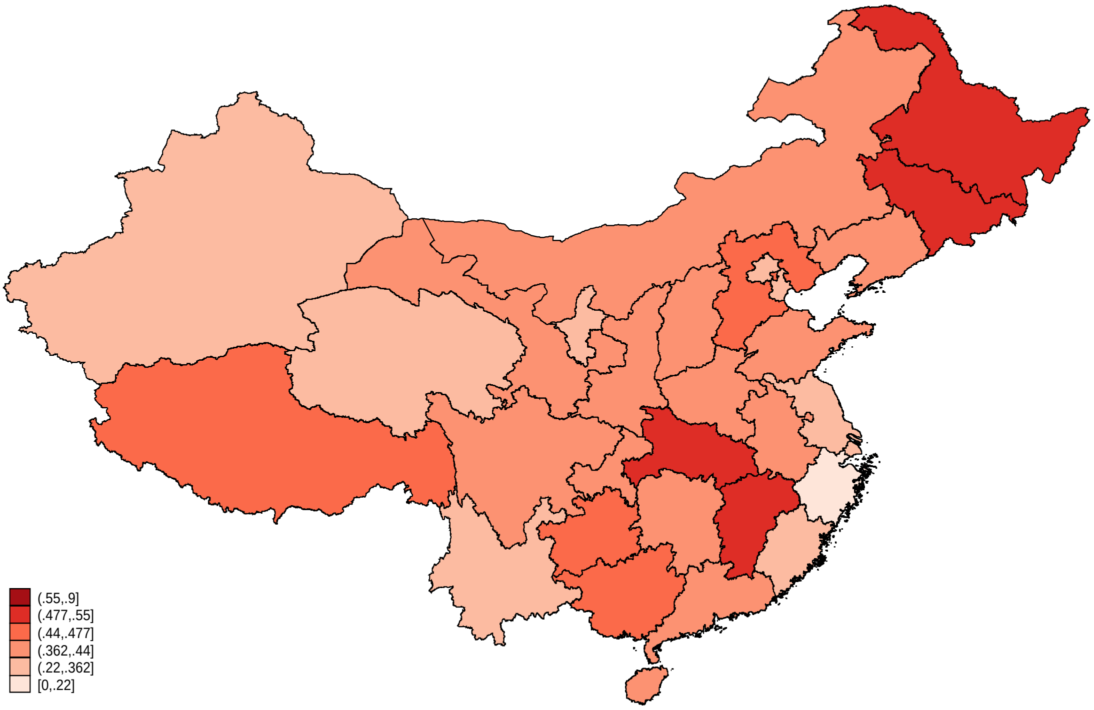


Figure 3.3 Panel D: Misallocation in 2005

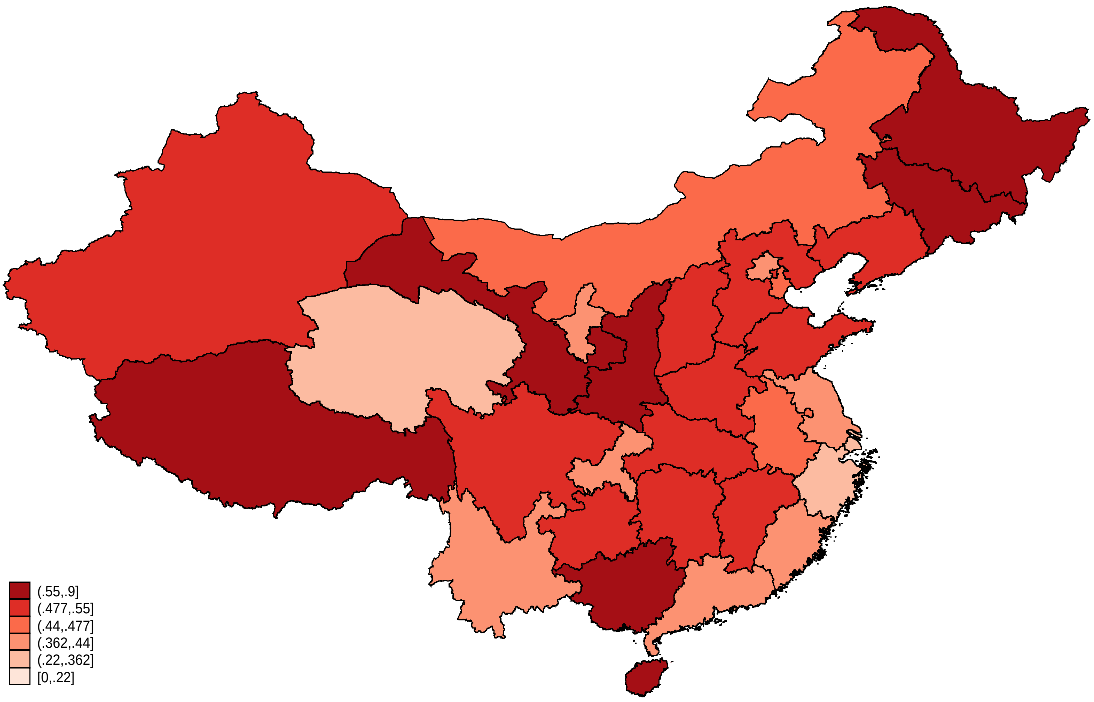


Figure 3.4: Misallocation across Provinces

Chapter 4 Listing, Profitability and Productivity

4.1 Introduction

Large amount of empirical research has revealed the benefits of capital market development, such as increasing innovation (Hsu et al, 2014), absorbing shocks (Frank and Sanita, 2018), and promoting economic growth (Levine and Zeros, 1995; Aghion et. al., 2005). A natural question then is: what are the effects of capital market development on firms' outcomes? Research on this question has focused on the effects of listing on firm's innovation and investment activities. For example, Hsu, Tian and Xu (2014) found equity market development encourages innovation while credit market development discourages innovation using country level data.

A recent paper by Bernstein (2015) investigated the effects of listing on stock market on innovation by comparing the group of firms that go public and the group of firms that withdraw their initial public offering filing. Using the amount of successful patent application to measure innovation, and NASDAQ fluctuations as instrument for listing, he finds internal innovation declines after listing, due to listed firms reducing internal innovations but acquiring external innovations. This offers evidence that listing on a stock market also changes firm's behavior.

A firm's decision to be listed on a stock exchange stems from different reasons. For example, firms can raise capital from the stock market with lower financing cost, increase reputation, and improve liquidity of equity. Moreover, firm's equity owners will also have chances to optimize equity value by listing on stock market. A question then emerges to equity owners and potential newcomers is: does listing on a stock exchange have a positive effect on firm's profitability and technology?

The main goal of this paper is to provide quantitative evidence on the potential effects of listing on firm's profitability and technology. In theory, financial development should have positive effect on convergence (Aghion, et al, 2005) and economic growth

(Blackburn, et al, 1998; Levine and Zeros, 1999).

I follow Hsieh and Klenow (2009) and Foster et al (2008) in using revenue productivity and physical productivity to measure firm's profitability and technology, respectively. Revenue productivity is computed as the value-added of a firm divided by the labor and capital input. Compared with the nominal profits or nominal net profit, revenue productivity could measure a firm's ability to earn profits better.

I use Chinese firm-level data from the Annual Surveys of Industrial Production (ASIP) (1998-2007). The large data set includes information of more than 2 million manufacturing firms over 10 years. However, listing information is not available in the ASIP data. I use data from WIND database which only includes the information of listing firms and then merge it with the ASIP data. Summary statistics show that listed firms have lower average profitability but higher technology levels across the 10 years. The decision to be listed on the stock market for firms can be endogenous due to reverse causality and unobserved variables. For instance, if owners expect their firm will be more profitable in the future and has no liquidity pressure, they might tend to listing the firm to the stock market. To tackle this endogeneity concern, I use the number of investment banks in a city as instrument variable. The number of investment banks in a city should not be correlated with a firm's profitability or technology besides through listing, because in the first place, for a firm to be listed in a stock exchange it has to be underwritten by investment banks. Second, it is usually the banks that offer financing to firms in China, and investment banks will have little connection to firms if it's not about listing. Data on start-up venture capital such as that used by Asker and Farre-Mensa (2014) is not available, neither are stock price fluctuations as in Bernstein (2015). Instead, I use the number of investment banks in the current year and the numbers of investment banks in the former year or the past 5 years as instrument in a difference-in-difference model. I find that listing on a stock exchange increases firm's profitability and technology (when the values of the elasticity of substitution between firm's value-added is assumed to be large numbers [12]). However, new investment banks or branches

[12] I assume different values for elasticity of substitution between firm's value-added following Broda and Weinstein (2006).

may be established where there are potential qualified firms to be listed on the stock market. Using the number of investment banks at specific years from 1994 to 1998 as instrument shows that the conclusions are robust: listing increases profitability and technology.

Moreover, investment banks are usually located in large cities, and the instrument variable might capture the effects of geographic location near large markets. I include dummy variables to divide firms into a group that are located in large cities and a group that are not in large cities. The latter is defined as all 31 province capital cities and other 6 large port cities as large cities. After controlling for the geographic effects, I still find consistent conclusions that listing increases profitability and technology. State-owned enterprise reforms also happen at the beginning of the sample period. The results are still consistent after controlling firm’s ownership. As there are requirements about profits for listing, I truncate the data set to keep all listing firms and other firms with top 25% profit only. The results show that listing increases profitability of listed firms comparing with the rest firms in the truncated sample.

In addition, besides profitability and technology, I investigate what other changes listing brings to firm’s balance sheet. It’s worth checking because changes on firm’s balance sheet such as income, profit and wages might provide insights as to the mechanism whereby listing affects profitability and technology. The results show that listing increases firm’s fixed assets and long-term investment, long-term liabilities, state-owned, corporate and personal capital, and nominal profits, and decreases other assets beside fixed asset, current liabilities, total liabilities, foreign capital, and cost. However, listing also decreases all kinds of wages and welfare, and increases all kinds of taxes.

Although Bernstein (2015) examined the effects of listing on innovation with firms who submitted an application to be listed, I take a new approach to measure profitability and technology measured by TFPR and TFPQ, respectively. In addition, I use a new instrument to tackle endogenous concerns. My research is also related to other studies such as Hsu, Tian and Xu (2014) who find equity market development increases innovation, and Fama and French (2004) and Doidge et al (2017) find that listing changes firm’s many characteristics.

The rest of the paper proceeds as follows. I describe the data and show summary statistics in Section 4.2. Section 4.3 presents the empirical strategy. Section 4.4 provides the main results. I conduct robustness check in Section 4.5. Section 4.6 analyzes potential bias. And Section 4.7 concludes.

4.2 Data

The data I use is from Annual Surveys of Industrial Production from 1998 through 2007, collected by China's National Bureau of Statistics. The data includes non-state-owned-enterprises with nominal revenue over 5 million yuan, and all state-owned-enterprise (SOE). There are over 2 million firms in the data across the ten years, with the number of firms ranging from over 165,000 in 1998 to 330,000 in 2007. Firm's information such as firm's name, address, subdivided industry code, age, value-added, capital stock, wage payments, ownership, profits, assets, tax and subsidy is included in the data.

The information about firms listed in a stock market is from WIND, which includes name, stock code, listing time (year, month and date), listed stock exchange, and other information of all listed firms since the establishment of the stock exchange in 1990. The number of listed firms in the manufacturing sector increases from 299 in the beginning of 1998 to 792 by the end of 2007. Since there is no information about listing in the ASIP data, I am not able to identify which firms are listed on a stock exchange in the ASIP data set. As mentioned above, the data set from WIND includes information such as name and listing time of all listed firms. Therefore, I merge the data set of listed firms from WIND to the ASIP data set by firm's name. I identify 661 firms listed in a stock exchange in the Annual Surveys of Industrial Production data set.

I follow Foster et al (2008) and Hsieh and Klenow (2009) to measure profitability and technology, which firm's profitability (TFPR) is measured by the ratio of value-added to capital and labor input, and firm's technology (TPFQ) is measured by the ratio of output quantity to capital and labor input. However, the quantity of output cannot be observed in the data set. I still follow Hsieh and Klenow (2009) to compute TFPQ by scaling up value-added in TFPR with the elasticity of substitution between firm's value-added. Specifically, TFPR and TFPQ are defined and computed as follows,

$$TFPR = PA = \frac{PY}{K^{\alpha}L^{1-\alpha}} \tag{4.1}$$

$$TFPQ = A = \frac{Y}{K^{\alpha}L^{1-\alpha}} = \frac{(PY)^{\frac{\sigma}{\sigma-1}}}{K^{\alpha}L^{1-\alpha}} \tag{4.2}$$

where P refers to price level, Y refers to the quantity of output for firms, and PY to value-added. K and L are capital and labor input respectively for firms, and sigma is the elasticity of substitution between firm value-added, which sigma typically ranges from three to ten in the literatures (e.g. Broda and Weinstein, 2006). I report the empirical results as sigma is set to be different values.

Table 4.1 shows the summary statistics of listed firms and non-listed firms. Column (1) depicts the TFPR of listing firms by the end of 1998, 2003 and 2007, which the mean of TFPR of listing firms decreases from 1998 to 2003, and increases from 2003 to 2007. The mean of TFPR for non-listing firms in column (2) increases from 1998 to 2007, and the values of each year in column (2) is larger than those in column (1), respectively, which means even though listed firms are usually larger firms, the average profitability is lower than non-listing firms. Columns (3) and (4) are the mean values of TFPQ of listing and non-listing firms in different years, respectively. TFPQ values of listing firms are much larger than those of non-listing firms of each year correspondingly. Moreover, 1 also shows that the number of identified listed firms increases from 299 by the end of 1998 to 661 in 2007, and the number of investment banks increases from 90 in 1998 to 243 in 2007.

4.3 Empirical Strategy

The specification I use to identify the effects of listing on a stock exchange on firm's profitability and technology is as follows:

$$Y_{it} = \alpha_1 + \gamma_1 Listing_{it} + \beta_1 (Post \times Listing)_{it} + X_{it}\delta_1 + \lambda_{1s} + \lambda_{1p} + \lambda_{1t} + \varepsilon_{1it} \tag{4.3}$$

where Y_{it} refers to the outcome of firm i, firm's profitability (TFPR) or technology (TFPQ). $Listing_{it}$ is a dummy variable, which it equals to one if firm i is listed on a stock exchange, otherwise zero. $(Post \times Listing)_{it}$ equals to one after firm i listed on a stock market, and equals to zero for listing firms before they are listed on a stock exchange, and for non-listing firms. X_{it} includes control variables such as firm's age and value-added. λ_{1s}, λ_{1p}, and λ_{1t} are industry, province and year fixed effects, respectively. γ_1, β_1 and δ_1 are coefficients, α_1 is the constant, and ε_{1it} is the error term. I am interested in the coefficient β_1, which captures the effects on a firm's TFPQ and TFPR after listing on a stock exchange. Specifically, it measures the difference of outcomes for firms after listing on a stock market compared with outcomes before listing and with non-listing firms.

However, listing on a stock exchange can be endogenous for firms. The first reason can be reverse causality. Firm owners seek to listing on a stock exchange might be out of avoiding future profitability drop, since firm owners usually know more about firm's operation status whether there is high probability of profitability drop. Or listing on a stock exchange will make firms more profitable by increasing firm's reputation, therefore, firm owners will decide to list firms on stock exchanges.

The other possible reason could be unobserved variables. Many unobserved factors could affect firm's profitability and technology, such as industrial policies and financial restrictions. For example, financial restrictions, could be correlated with firm's decision about listing on a stock exchange, but cannot be observed or measured. Therefore, listing on a stock exchange can be endogenous to firm's profitability and technology.

I use the number of investment banks in a city as instrument variable to address the endogeneity issue. The number of investment banks is correlated with firm's profitability or technology only through listing. The main business activities for investment banks are securities brokerage, buying and selling stocks, and securities underwriting. Investment banks are the only institutions that assist firms to list on a stock exchange. Investment banks will not help with firm's financing unless they are underwriting firm's stocks, which instead the main source of funds for firms in China is from banks.

In the first-stage regression, I regress the firm's outcomes on the number of investment banks in the city where the firm is located in, and the specification is as follows,

$$Listing_{it} = \alpha_2 + \gamma_2 InvBank_{it} + \beta_2 (Post \times InvBank)_{it} + X_{it}\delta_2 + \lambda_{2s} + \lambda_{2p} + \lambda_{2t} + \varepsilon_{2it} \quad (4.4)$$

$$(Post \times Listing)_{it} = \alpha_3 + \gamma_3 InvBank_{it} + \beta_3 (Post \times InvBank)_{it} + X_{it}\delta_3 + \lambda_{3s} + \lambda_{3p} + \lambda_{3t} + \varepsilon_{3it} \quad (4.5)$$

where $InvBank_{it}$ and $(Post \times InvBank)_{it}$ are the instrument variables for $Listing_{it}$ and $(Post \times Listing)_{it}$, respectively. The second-stage equation to estimate the effects of listing on firm's outcomes is as follows,

$$Y_{it} = \alpha_4 + \gamma_4 \overline{Listing}_{it} + \beta_4 \overline{(Post \times Listing)}_{it} + X_{it}\delta_4 + \lambda_{4s} + \lambda_{4p} + \lambda_{4t} + \varepsilon_{4it} \quad (4.6)$$

Where $\overline{Listing}_{it}$ and $\overline{(Post \times Listing)}_{it}$ are predicted values from (4.4) and (4.5). I complete the estimations using two-stage least squares (2SLS). Robust standard errors are computed for both the first- and second-stage regressions.

Moreover, the number of investment banks in a city is an appropriate instrument variable for listing because it satisfies the relevance condition and exclusion condition. As mentioned above, the number of investment banks is correlated to firm's listing, because firms to be listed on a stock exchange have to be underwritten by investment banks. The estimated coefficients reported in Table 4.2 show that the number of investment banks have a significant effect on firm's listing. The number of investment banks in a city has no correlation with firm's profitability and technology besides by listing. Therefore, the number of investment banks should be correlated with firm's profitability and technology only through listing.

4.4 Results

In Table 4.2 I report the first-stage results of listing on the number of investment bank. Column (1) reports the effects of the number of investment bank at current year on listing, and the positive and significant coefficient indicates that the more of investment banks at the current year in a city, more firms will be listed on a stock exchange. However, the process of listing since the startup until being listed on a stock exchange may last several months or more than one year. Therefore, I include the lags of the number of investment banks in a city as instrument variables. The positive and significant coefficients across columns (2) to (6) indicate that the more of investment banks in a city in the former years, the more firms from the city will be listed on a stock exchange. Moreover, the coefficients become larger (except the one in column (1)) with the leading periods, which means the number of investment banks in earlier years has larger effects on the number of listing firms than in the later years.

Table 4.3 reports the main results of listing on firm's profitability. The instrument in column (1) is the number of investment banks at current year. The coefficient of the interaction is positive and significant, which indicates firms becomes more profitable after listing on a stock exchange. I use the number of investment banks in former years to replace the number of investment banks in the current year as instrument variables across columns (2) to (6). I do find positive and significant coefficients of the interaction. Moreover, the coefficient of the number of investment banks five years ago is larger than those of the later years, indicating that cities where a larger number of investment banks were located originally, the larger the probability of a firm being listed on the stock exchange.

Table 4.4 reports the effects of listing on firm's technology, where technology is measured by TFPQ and is computed from TFPR by assuming the elasticity of substitution between firm's value-added equals 3. The instrument variables are the number of firms of the current year and the former years. The coefficients of the interaction are not significant across all the columns, which means that listing on a stock exchange has no significant effects on firm's technology.

As mentioned above, TFPQ is computed from TFPR by scaling up firm's value-added, it will first bring errors to measure technology by assuming the same elasticity of substitution [13] between firm's value-added. Secondly, when assuming different values to elasticity of substitution, it might also result in different effects of listing on firm's technology. Therefore, Table 4.5 reports the effects of listing on firm's technology when

[13] Elasticity of substitution between firms measures the ease with which a firm can be substituted for others.

the elasticity of substitution is assigned different values as robustness check. Columns (1) and (2) show the effects of listing on firm's TFPQ when sigma is set to be 5, but the instrument variables are the number of investment banks at current year and 3 years ago. The coefficients of the interaction are significantly positive, indicating that listing on a stock exchange increases firm's technology. Columns (3) to (6) also check the effects of listing on technology when sigma values are set to be 7 and 10, and all the coefficients of the interaction are significantly positive, which the results are consistent with columns (1) and (2). The values of elasticity of substitution do not affect the empirical results.

Therefore, listing on a stock exchange has significantly positive effects on firm's technology, when technology is computed with larger values of elasticity of substitution between firm's value-added. The effects of listing on technology are insignificant only when the elasticity of substitution is assumed to be 3, which is the lowest of the values. Larger (smaller) elasticity of substitution means higher (lower) price level and lower (higher) technology level for a given profitability level. When the elasticity of substitution is small, firms are with lower price level and higher technology level, and listing has little effects on technology of these firms.

To sum it up, I use the number of investment banks in a city of the current and former years as instrument variables to examine the effects of listing on firm's profitability and technology, and find listing increases firm's profitability and technology.

4.5 Robustness Results

4.5.1 Potential Selection Bias

Selection bias arise might be because new investment banks or branches are established in cities where there are more qualified listing firms. The number of investment banks in Table 4.1 is increasing from 90 in 1998 to more than 240 in 2007. Some new investment banks or new branches might select the locations where there are potential listing firms. Investment banks may help to improve profitability of firms who are at the margin of the requirements to be listed, even though with very low probability.

To tackle this problem of inverted selection of qualified firms and investment banks, I use the number of investment banks in a specific earlier year (1990 to 1998) as an instrument. Table 4.6 reports the results of the number of investment banks in the year 1994 to 1998 on listing [14]. The coefficient in column (1) is significantly positive, indicating that the more of investment banks in a city in 1994, the more firms will be listed on a stock exchange during 1998 to 2007. Specifically, for each additional investment bank in a city, there will be two more firms out of 10,000 firms listed in a stock exchange in later years. The coefficients across columns (2) to (6) are all significantly positive, indicating that the more number of pre-determined investment banks in a city, the more of firms will be listed on a stock exchange. As there are only 661 listed firms by the end of 2007, the initial number of investment banks had a large effect on later listing.

Table 4.7 shows the results of the second-stage of listing on firm's TFPR using the number of investment banks at a specific former year. The coefficients of the interaction across columns (1) to (5) are all significantly positive, which means with an extra investment bank in a city, more firms will be listed on a stock exchange in later years. Table 4.8 reports the results of the second-stage of listing on firm's TFPQ with the number of investment bank at a specific former year as instrument variable when the elasticity of substitution is assumed to be 3. The coefficients of the interaction across columns (1) to (5) are all negative, but not significant. Table 4.9 includes the results of listing on a stock exchange on TFPQ when use a larger elasticity of substitution. Coefficients of the interaction when elasticity of substitution equaling 5 is not significant, and the coefficient is also insignificant when sigma equals to 7 and the number of investment bank in 1995 as instrument variable. When sigma equals to 10, the coefficients of the interaction are significantly positive with the number of investment bank in both 1995 and 1998. The effects of listing on TFPQ are similar with the result above when assuming different values to the elasticity of substitution. Listing has significantly positive effects on TFPQ of firms with lower TFPQ, and insignificant

[14] The omitted results also show the number of investment banks at the years from 1990 to 1993 is good instrument for listing.

effects on TFPQ of firms with higher TFPQ values.

4.5.2 Spillover Effects of Large Cities

As investment banks have no or little connections with firms unless it's because of listing, investment banks will not affect firm's profitability or technology through other channels. However, using the number of investment banks as instrument may capture the spillover effects of large cities. As mentioned above, most of the investment banks or branches are located in the downtown areas of large cities. If firms in the large cities are more profitable and/or have higher technology due to stronger market demand, the coefficient will be biased upwards as they will capture the geographic effects of being in large cities. This is not likely to be a big problem, because first manufacturing firms are usually located in urban areas far away from the downtown. Second, manufacturing products produced away from large cities could also be sold to customers all over the country if they are competitive enough.

To tackle the potential issue that the number of investment bank may capture the geographic effects of being close to large cities, I include a dummy variable referring to large cities and an interaction variable of after-listing and the dummy variable. Specifically, the dummy variable equals to 1 if a firm is from the 31 capital cities of all provinces and 6 other large port cities, and 0 otherwise.

Table 4.10 reports the results of listing on TFPR where I control for the geographic effects. I first only include the dummy variable of large cities as control variable in columns (1) to (4), and the results show that the coefficients of the interaction of listing and period dummy are still significantly positive, which is consistent with the conclusions above. Moreover, the coefficients of the dummy variable for large cities are significantly negative, indicating that firms in large cities usually have lower profitability. One possible explanation might be that more firms are in large cities, and the market is more competitive. Therefore, firms in large cities are with lower profitability. After controlling the interaction of the geographic dummy and period dummy, the coefficients of listing interaction are still significantly positive on firm's

TFPR, but coefficients of the interaction between the period dummy and large city dummy are not significant.

Moreover, I also estimate the effects of listing on TFPQ assuming the elasticity of substitution takes on different values, the results are in Table 4.11. Consistent with the conclusions above, listing has insignificant effects on firm's TFPQ when sigma is set to be 3, and has significant effects on firm's TFPQ when sigma is assumed to be larger, even after controlling the geographic effects. As TFPQ is computed from TFPR with equation (4.2), smaller (larger) sigma means a firm has higher (lower) technology but lower (higher) markup [15]. Firms with higher technology might be associated with lower cost (Haltiwanger et al., 2018), which allows firms to charge lower prices.

Therefore, after controlling the geographic effects that firms near to large cities might be more profitable and more technology-advanced, the coefficients to measure the effects of listing on profitability and technology (partly) are still significantly positive, indicating that listing has increased firm's profitability and technology.

4.5.3 SOE Reforms

The estimated effect of listing in a stock exchange on firm's profitability and technology may also capture the effects of State-Owned Enterprise (SOE) reforms. The SOE reforms started and mostly happened in 1998. The aim of the SOE reforms were to cut excessive production capacity and allow firms to transfer debt into equity in some industries. Meanwhile, most listed firms in the late 1990s and early 2000s are SOE. Hence, listing might capture the effects of SOE reforms.

I add control variables of SOE reforms to examine if listing still has significant effects on firm's profitability and technology. The data set includes information of firm's ownership, based on which I construct a dummy variable that takes on the value of one if the firm is a SOE. Columns (1) to (4) in Table 4.12 report the results of listing on profitability after controlling SOE reforms dummy variable. The coefficients of the interaction are still positive and significant, indicating that listing still has positive

[15] As the quantity of products for firms is not available in the data, I check the results when sigma is set to be different values, and the results are consistent.

effects on profitability after controlling SOE reforms effects. However, the coefficients of the ownership dummy are all significantly negative, which means SOE had lower profitability than non-SOE over the period. Moreover, some SOE might change their ownership due to SOE reforms or listing. Thus, I also include the interaction between the period dummy and ownership dummy in columns (5) to (8). The results show that listing still has significantly positive effects on firm's profitability after controlling for firm's ownership.

Moreover, I examine the effects of listing on firm's technology. Like above, I assume different values for sigma in order to compute TFPQ. The estimation results for the effect of listing on TFPQ computed with different values of sigma are shown in Table 4.13. Consistent with the previous results, I find that listing has no significant effects on firm's TFPQ when sigma is set to be 3, but has significantly positive effects on TFPQ when sigma is set be to larger. However, the coefficients of ownership are all significantly negative across all columns, indicating that SOE have lower technology levels.

4.5.4 Requirements of Listing on a Stock Exchange

By the end of 2007, there are only two main boards on the stock market in Shanghai Securities Exchange and Shenzhen Securities Exchange respectively. The two main boards have the same requirements for firms to be listed on the stock market. Specifically, the requirements focus on firm's (accumulative) profits, net cash flow and (accumulative) operational income. For example, one requirement states that firms qualified to be listed should have positive profits of the last 3 years consecutively, or the accumulative net profit should be larger than 30 million yuan. Therefore, investment banks might focus more on seeking large-size firms to help them to be listed and neglect small firms. I sort the data set into smaller subsamples based on profits as robustness check. Specifically, I first identify the top 25% value for firm's profits in 1998, and then drop firms whose profit is lower than the top 25% value in 1998. The reason I use profit instead other variables such as net cash flow or income is because there is a large amount of missing data for these variables.

The results of listing on profitability and technology of the sample with qualified or potential qualified firms are reported in Table 4.14. I use the number of investment banks of current and former years as instrument variables respectively. Columns (1) to (4) show the effects of listing on TFPR. Consistent with the results above, the coefficients of the interaction are all significantly positive, indicating listing increases profitability. Columns (5) to (8) report the results of listing on TFPQ, which TFPQ is computed when the elasticity of substitution is set to be 3. The coefficients of the interaction are not significant.

Robustness checks when TFPQ is computed with different values are reported in Table 4.15. The coefficients of the interaction to measure effects of listing on TFPQ are all positive and significant, indicating that listing increases the technology level of firms with lower technology levels. Therefore, I still find consistent conclusions that listing increases firm's profitability and technology with small sample of more qualified firms.

4.6 Potential Channels

Using Chinese firm level data, I find that listing on a stock exchange increases firm's profitability and technology. In this section, I further discuss what other aspects of firms change after listing on a stock exchange. There are also many other variables about firm's assets, liabilities, capital, and so on. Using the same specification as above, I replace the dependent variables with other variables depicting such as firm's assets and liabilities, to examine the effects of listing on firm's characteristics.

The results of the effects of listing on firm's asset, liabilities, capital, income, profit and cost, wages and welfare, and taxes and subsidies are reported in Table 4.16. Column (1) includes the name of variables, and column (2) reports the sign of the coefficients of the interaction. As to firm's assets, listing significantly increases firm's fixed assets and long-term investment, and decreases firm's current assets and inventory. Moreover, listing reduces firm's total assets.

Listing decreases firm's total liabilities as is shown in row (12), and mainly by reducing current liabilities. However, listing increases firm’s long-term liabilities. The effects of listing on capital are interesting. After listing on a stock exchange, the state-owned capital, corporate capital and personal capital increase, but the Hong Kong, Macao and Taiwan capital and foreign capital decrease.

Listing does not increase outcomes such as sales value, export delivery value or main product sales revenue: in contrast, it leads to decrease in income. However, listing decreases operating profit and other profit. Listing decreases cost significantly, specifically, firm’s total loss, main product sales cost, intermediate input, operating expenses and management cost fall significantly. These results indicate that the increase in profit observed after firms list on a stock exchange is mainly due to the significant decrease of cost, rather than an increase in income.

However, the effects of listing on wages and welfare are all negative as can be seen from rows (38) to (42). Specifically, after listing in a stock exchange, firm’s employment decreases, payroll payable and wages payable for main business decreases, and welfare and welfare payable for main business decreases too. Meanwhile, it’s interesting that taxes measured by different methods increase after listing on a stock exchange, but the subsidies firms received are not significantly affected.

To sum up, listing changes the structure of firm’s assets, liabilities, and capital. After listing on a stock exchange, fixed assets and long-term investment increase, and current assets decrease too. Total liabilities and current liabilities decrease but long-term liabilities increase. And state-owned, corporate and personal capital increases, but foreign capital decreases. Moreover, both income and cost decrease, but profit increases. Wages and welfare do not change significantly after listing on a stock exchange, but taxes increased significantly.

4.7 Key Findings

I investigate the effects of listing on stock market on firm’s profitability and technology. After identifying the listed firms out of 2 million manufacturing firms across the years from 1998 to 2007, I compute revenue productivity and physical productivity to measure firm's profitability and technology. As Chinese stock exchanges require firms to be listed on the stock market need to be underwritten by investment banks, I use the number of investment banks in a city as instrument variable to tackle concerns regarding endogeneity of listing. With difference-in-difference model, I find that listing on the stock market increases firm's profitability and technology. After controlling variables of geographic effects and SOE reforms, the results are still significant.

Moreover, besides profitability and technology, firm's many other characteristics are affected by listing on a stock exchange. For example, listing increases firm's fixed assets, long-term liabilities, state-owned, corporate and personal capital, and profits, but decreases current assets, short liabilities, foreign capital and cost. In addition, wages and welfare decrease, and taxes increase. Future study may look further at the mechanism about how does listing affect firm's profitability and technology.

4.8 Tables

Table 4.1: Summary Statistics of Listing and Non-Listing Firms

Variable	TFPR		TFPQ		No. of listed firms	No. of investment bank
	Listed	Non-listed	Listed	Non-listed		
Year	(1)	(2)	(3)	(4)	(5)	(6)
1998	7.213	8.150	3172.2	694.5	299	90
	(12.66)	(20.11)	(8482.9)	(3042.9)		
2003	5.834	9.859	3594.1	1039.5	500	178
	(5.11)	(34.55)	(5974.3)	(5423.5)		
2007	7.539	12.102	5322.9	1736.1	661	243
	(10.96)	(60.97)	(9964.1)	(15736.1)		

Notes: Standard deviations are in the parentheses in columns (1) to (4). No. of listed firms refers to the number of listed firms by the end of the year, and No. of investment bank refers to the number of investment banks by the end of the year.

Table 4.2: First Stage Regressions Result of Listing on the Number of Investment Banks

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Listing					
NO. of Inv. Bank (t-0)	2.25e-05***					
	(3.96e-06)					
NO. of Inv. Bank (t-1)		2.19e-05***				
		(4.02e-06)				
NO. of Inv. Bank (t-2)			2.20e-05***			
			(4.09e-06)			
NO. of Inv. Bank (t-3)				2.30e-05***		
				(4.25e-06)		
NO. of Inv. Bank (t-4)					2.34e-05***	
					(4.53e-06)	
NO. of Inv. Bank (t-5)						2.51e-05***
						(4.94e-06)
Constant	0.000795**	0.000902***	0.000972***	0.00104***	0.00115***	0.00121***
	(0.000325)	(0.000320)	(0.000318)	(0.000314)	(0.000311)	(0.000308)
Observations	2,003,775	2,003,775	2,003,775	2,003,775	2,003,775	2,003,775
R-squared	0.018	0.018	0.018	0.018	0.018	0.018
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: NO. of Inv. Bank (t-0) refers to the number of investment banks in a city where firms are located in at the current year. And NO. of Inv. Bank (t-1) refers to the number of investment bank in a city one year ago. Control variables include firm's age and size, which age is measured by year and size is measured by firm's value-added. The count variable of the number of investment banks might affect the results, I also use the number of investment banks per firm in a city as robustness checks, the results are consistent. Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 4.3: Effects of Listing on a Stock Exchange on Firm’s TFPR

	(1)	(2)	(3)	(4)	(5)	(6)
Instrument	N(t-0)	N(t-1)	N(t-2)	N(t-3)	N(t-4)	N(t-5)
Listing	-1,638***	-1,614***	-1,527***	-1,567***	-1,640***	-1,707***
	(329.2)	(331.6)	(311.4)	(319.7)	(336.5)	(371.9)
Post*Listing	1,627***	1,604***	1,517***	1,557***	1,629***	1,696***
	(328.0)	(330.4)	(310.2)	(318.5)	(335.2)	(370.4)
Age	-0.00281***	-0.00281***	-0.00281***	-0.00281***	-0.00282***	-0.00282***
	(0.000493)	(0.000488)	(0.000470)	(0.000479)	(0.000494)	(0.000508)
Value-added	6.74e-06***	6.66e-06***	6.39e-06***	6.51e-06***	6.74e-06***	6.94e-06***
	(1.28e-06)	(1.28e-06)	(1.21e-06)	(1.24e-06)	(1.29e-06)	(1.39e-06)
Constant	16.11	16.10***	16.05***	16.07***	16.11***	16.15***
	(0.368)	(0.370)	(0.357)	(0.368)	(0.377)	(0.393)
Observations	2003774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	-0.5322	-0.516	-0.460	-0.486	-0.533	-0.579
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. All regressions passed the over-identification test, under-identification test and weak identification test. The count variable of the number of investment banks might affect the results, I also use the number of investment banks per firm in a city as robustness checks, the results are consistent. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4.4: Effects of Listing on a Stock Exchange on Firm’s TFPQ

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	TFPQ (Sigma=3)					
Instrument	N(t-0)	N(t-1)	N(t-2)	N(t-3)	N(t-4)	N(t-5)
Listing	-7,661	-15,343	1,626	-14,915	-45,149	-30,795
	(131,298)	(140,931)	(138,348)	(152,049)	(147,791)	(160,898)
Post*Listing	6,177	13,849	-2,946	13,692	43,948	29,939
	(131,352)	(140,927)	(138,398)	(152,018)	(147,792)	(160,884)
Age	-0.219***	-0.220***	-0.219***	-0.221***	-0.224***	-0.223***
	(0.0519)	(0.0527)	(0.0522)	(0.0530)	(0.0537)	(0.0527)
Value-added	0.00662***	0.00665***	0.00659***	0.00664***	0.00673***	0.00667***
	(0.000664)	(0.000673)	(0.000648)	(0.000658)	(0.000655)	(0.000624)
Constant	1,317***	1,322***	1,312***	1,321***	1,339***	1,330***
	(102.1)	(107.0)	(107.7)	(114.1)	(112.1)	(119.2)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	0.004	0.004	0.004	0.004	0.003	0.004
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. TFPQ is computed from TFPR by assuming sigma equal to different values, in which above sigma is set to be 3. All regressions passed the over-identification test, under-identification test and weak identification test. The count variable of the number of investment banks might affect the results, I also use the number of investment banks per firm in a city as robustness checks, the results are consistent. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.5: Robustness Check of Effects of Listing on Firm's TFPQ

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	TFPQ (sigma=5)		TFPQ (sigma=7)		TFPQ (sigma=10)	
Instrument	N(t-0)	N(t-3)	N(t-0)	N(t-3)	N(t-0)	N(t-3)
Listing	-13,004***	-13,344***	-6,920***	-6,935***	-4,202***	-4,142***
	(3,935)	(4,386)	(1,647)	(1,744)	(911.8)	(931.7)
Post*Listing	12,907***	13,250***	6,873***	6,889***	4,175***	4,115***
	(3,926)	(4,375)	(1,641)	(1,739)	(908.6)	(928.3)
Age	-0.0238***	-0.0238***	-0.0120***	-0.0120***	-0.00717***	-0.00717***
	(0.00472)	(0.00479)	(0.00229)	(0.00230)	(0.00133)	(0.00132)
Value-added	0.000183***	0.000184***	6.17e-05***	6.17e-05***	2.78e-05***	2.76e-05***
	(2.11e-05)	(2.13e-05)	(7.95e-06)	(7.96e-06)	(4.02e-06)	(3.99e-06)
Constant	142.4***	142.6***	70.26***	70.27***	41.58***	41.54***
	(4.291)	(4.618)	(1.876)	(1.970)	(1.041)	(1.074)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	-0.085	-0.090	-0.177	-0.178	-0.277	-0.269
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. TFPQ is computed from TFPR by assuming sigma equal to different values, in which above sigma is set to be 3. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.6: First Stage Results of Listing on the Number of Investment Banks at Specific Early Years

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Listing				
NO. of Inv. Bank at 1994	0.000202***				
	(3.45e-05)				
NO. of Inv. Bank at 1995		4.51e-05***			
		(6.81e-06)			
NO. of Inv. Bank at 1996			3.94e-05***		
			(5.90e-06)		
NO. of Inv. Bank at 1997				3.38e-05***	
				(5.58e-06)	
NO. of Inv. Bank at 1998					3.21e-05***
					(5.44e-06)
Constant	0.00145***	0.00104***	0.00110***	0.00112***	0.00113***
	(0.000305)	(0.000311)	(0.000310)	(0.000310)	(0.000310)
Observations	2,003,775	2,003,775	2,003,775	2,003,775	2,003,775
R-squared	0.018	0.018	0.018	0.018	0.018
Year FE	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

Notes: NO. of Inv. Bank at 1994 refers to the number of investment bank in a city in the year 1994. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.7: Effects of Listing on TFPR with the Number of Investment Banks at Early Years as Instrument

	(1)	(2)	(3)	(4)	(5)
Instrument	N(1994)	N(1995)	N(1996)	N(1997)	N(1998)
Listing	-1,604***	-561.5***	-538.4***	-923.0***	-991.0***
	(341.3)	(152.3)	(148.4)	(221.8)	(238.6)
Post*Listing	1,594***	557.1***	534.0***	916.9***	984.6***
	(339.9)	(151.7)	(147.8)	(221.0)	(237.6)
Age	-0.00281***	-0.00272***	-0.00272***	-0.00276***	-0.00276***
	(0.000486)	(0.000307)	(0.000304)	(0.000358)	(0.000369)
Value-added	6.64e-06***	3.32e-06***	3.25e-06***	4.46e-06***	4.67e-06***
	(1.30e-06)	(6.83e-07)	(6.71e-07)	(8.92e-07)	(9.42e-07)
Constant	16.09***	15.48***	15.47***	15.69***	15.73***
	(0.371)	(0.253)	(0.252)	(0.288)	(0.296)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	-0.510	-0.048	-0.042	-0.157	-0.184
Year FE	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

Notes: N(1994) refers to the number of investment bank in a city at the year 1994. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.8: Effects of Listing on TFPQ with the Number of Investment Banks at Early Years as Instrument

	(1)	(2)	(3)	(4)	(5)
VARIABLES	TFPQ (Sigma=3)				
Instrument	N(1994)	N(1995)	N(1996)	N(1997)	N(1998)
Listing	106,846	189,933	191,536	176,053	175,265
	(123,876)	(132,839)	(132,324)	(141,771)	(144,029)
Post*Listing	-108,248	-188,626	-190,265	-175,016	-174,341
	(124,016)	(132,905)	(132,393)	(141,787)	(144,037)
Age	-0.208***	-0.207***	-0.207***	-0.208***	-0.208***
	(0.0579)	(0.0699)	(0.0702)	(0.0677)	(0.0676)
Value-added	0.00628***	0.00595***	0.00594***	0.00600***	0.00600***
	(0.000645)	(0.000629)	(0.000629)	(0.000622)	(0.000620)
Constant	1,251***	1,200***	1,199***	1,208***	1,209***
	(104.1)	(110.1)	(109.9)	(113.3)	(114.4)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	-0.005	-0.027	-0.027	-0.022	-0.022
Year FE	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

Notes: N(1994) refers to the number of investment bank in a city at the year 1994. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.9: Robustness Check of Effects of Listing on TFPQ with the Number of Investment Banks at Early Years as Instrument

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	TFPQ(sigma=5)		TFPQ(sigma=7)		TFPQ(sigma=10)	
Instrument	N(1995)	N(1998)	N(1995)	N(1998)	N(1995)	N(1998)
Listing	891.5	-2,339	-849.3	-2,563**	-919.6**	-1,974***
	(2,864)	(3,190)	(938.3)	(1,155)	(451.6)	(618.6)
Post*Listing	-878.2	2,331	844.5	2,548**	912.9**	1,962***
	(2,862)	(3,186)	(936.7)	(1,152)	(450.4)	(616.5)
Age	-0.0227***	-0.0229***	-0.0115***	-0.0116***	-0.00690***	-0.00699***
	(0.00340)	(0.00345)	(0.00150)	(0.00162)	(0.000842)	(0.000950)
Value-added	0.000138***	0.000149***	4.22e-05***	4.77e-05***	1.73e-05***	2.07e-05***
	(1.68e-05)	(1.73e-05)	(5.58e-06)	(6.07e-06)	(2.53e-06)	(2.96e-06)
Constant	134.2***	136.1***	66.69***	67.70***	39.65***	40.27***
	(3.750)	(3.842)	(1.475)	(1.559)	(0.769)	(0.841)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	0.007	0.004	0.007	-0.016	-0.002	-0.052
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(1995) refers to the number of investment bank in a city at the year 1995. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.10: Effects of Listing on TFPR with Controlling Geographic Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Instrument	N(t-0)	N(t-1)	N(t-2)	N(t-3)	N(t-0)	N(t-1)	N(t-2)	N(t-3)
Listing	-1,400***	-1,378***	-1,291***	-1,343***	-1,403***	-1,382***	-1,293***	-1,345***
	(310.3)	(314.2)	(293.1)	(304.2)	(314.0)	(318.2)	(296.7)	(308.2)
Post*Listing	1,390***	1,369***	1,282***	1,334***	1,384***	1,361***	1,277***	1,329***
	(309.2)	(313.0)	(292.0)	(303.0)	(304.7)	(307.9)	(286.4)	(296.1)
LargeCity	-0.244**	-0.246**	-0.257**	-0.251**	-0.260**	-0.265**	-0.269**	-0.262**
	(0.109)	(0.109)	(0.107)	(0.108)	(0.116)	(0.116)	(0.116)	(0.121)
Post* LargeCity					9.864	11.59	7.811	7.029
					(28.98)	(31.73)	(34.55)	(40.82)
Age	-0.00279***	-0.00279***	-0.00278***	-0.00278***	-0.00277***	-0.00277***	-0.00277***	-0.00277***
	(0.000445)	(0.000440)	(0.000423)	(0.000434)	(0.000448)	(0.000444)	(0.000428)	(0.000440)
Value-added	6.00e-06***	5.94e-06***	5.66e-06***	5.82e-06***	6.15e-06***	6.11e-06***	5.78e-06***	5.93e-06***
	(1.18e-06)	(1.18e-06)	(1.10e-06)	(1.14e-06)	(1.38e-06)	(1.41e-06)	(1.36e-06)	(1.46e-06)
Constant	16.19***	16.18***	16.14***	16.16***	16.19***	16.18***	16.14***	16.17***
	(0.337)	(0.339)	(0.327)	(0.339)	(0.339)	(0.341)	(0.329)	(0.341)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	-0.384	-0.372	-0.324	-0.352	-0.386	-0.374	-0.325	-0.353
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. TFPQ is computed from TFPR by assuming sigma equal to different values, in which above sigma is set to be 3. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.11: Effects of Listing on TFPQ with Controlling Geographic Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	TFPQ (sigma=3)		TFPQ (sigma=5)		TFPQ (sigma=7)		TFPQ (sigma=10)	
Instrument	N(t-0)	N(t-3)	N(t-0)	N(t-3)	N(t-0)	N(t-3)	N(t-0)	N(t-3)
Listing	-66,882	-66,191	-14,600***	-14,787***	-7,067***	-7,060***	-4,026***	-3,972***
	(141,618)	(165,120)	(4,503)	(4,991)	(1,819)	(1,931)	(962.2)	(990.1)
Post*Listing	48,888	57,977	13,955***	14,240***	6,841***	6,851***	3,926***	3,876***
	(145,463)	(169,385)	(4,460)	(4,932)	(1,782)	(1,882)	(937.7)	(958.1)
LargeCity	28.34	44.08	0.560	0.743	-0.203	-0.177	-0.325	-0.324
	(51.03)	(66.00)	(2.028)	(2.413)	(0.782)	(0.896)	(0.392)	(0.435)
Post* LargeCity	16,540	6,859	550.4	452.0	180.8	164.7	74.30	69.94
	(23,997)	(34,830)	(767.9)	(1,123)	(264.6)	(385.9)	(120.3)	(174.2)
Age	-0.195***	-0.214**	-0.0229***	-0.0231***	-0.0116***	-0.0117***	-0.00701***	-0.00702***
	(0.0718)	(0.0866)	(0.00521)	(0.00547)	(0.00237)	(0.00243)	(0.00131)	(0.00133)
Value-added	0.00703***	0.00689***	0.000196***	0.000195***	6.46e-05***	6.44e-05***	2.83e-05***	2.80e-05***
	(0.000777)	(0.000880)	(2.58e-05)	(2.94e-05)	(9.59e-06)	(1.08e-05)	(4.73e-06)	(5.22e-06)
Constant	1,306***	1,303***	142.1***	142.2***	70.30***	70.29***	41.67***	41.65***
	(97.77)	(108.3)	(4.424)	(4.703)	(1.896)	(1.980)	(1.024)	(1.056)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	0.000	0.001	-0.109	-0.112	-0.185	-0.185	-0.254	-0.246
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. TFPQ is computed from TFPR by assuming sigma equal to different values, in which above sigma is set to be 3. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4.12: Effects of Listing on TFPR with Controlling SOE Reforms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Instrument	N(t-0)	N(t-1)	N(t-2)	N(t-3)	N(t-0)	N(t-1)	N(t-2)	N(t-3)
Listing	-1,714***	-1,682***	-1,582***	-1,609***	-1,714***	-1,682***	-1,582***	-1,609***
	(345.1)	(346.0)	(322.6)	(328.1)	(345.1)	(346.0)	(322.6)	(328.1)
Post*Listing	1,702***	1,671***	1,571***	1,598***	1,703***	1,671***	1,571***	1,598***
	(343.8)	(344.7)	(321.3)	(326.8)	(343.8)	(344.7)	(321.3)	(326.8)
SOE Reform	-3.362***	-3.349***	-3.306***	-3.318***	-3.358***	-3.345***	-3.302***	-3.313***
	(0.206)	(0.206)	(0.195)	(0.197)	(0.207)	(0.206)	(0.196)	(0.198)
Post* SOE					-1.704	-1.644	-1.731	-1.781
Reform					(1.270)	(1.309)	(1.308)	(1.362)
Age	-0.00170***	-0.00170***	-0.00170***	-0.00170***	-0.00170***	-0.00170***	-0.00170***	-0.00170***
	(0.000505)	(0.000498)	(0.000477)	(0.000482)	(0.000505)	(0.000498)	(0.000477)	(0.000482)
Value-added	7.08e-06***	6.99e-06***	6.67e-06***	6.76e-06***	7.09e-06***	7.00e-06***	6.68e-06***	6.77e-06***
	(1.34e-06)	(1.33e-06)	(1.25e-06)	(1.27e-06)	(1.34e-06)	(1.33e-06)	(1.25e-06)	(1.27e-06)
Constant	17.72***	17.70***	17.62***	17.64***	17.72***	17.69***	17.62***	17.64***
	(0.429)	(0.430)	(0.410)	(0.421)	(0.429)	(0.430)	(0.411)	(0.421)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	-0.583	-0.562	-0.495	-0.512	-0.584	-0.562	-0.495	-0.512
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. TFPQ is computed from TFPR by assuming sigma equal to different values, in which above sigma is set to be 3. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.13: Effects of Listing on TFPQ with Controlling SOE Reforms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	TFPQ (sigma=3)		TFPQ (sigma=5)		TFPQ (sigma=7)		TFPQ (sigma=10)	
Instrument	N(t-0)	N(t-3)	N(t-0)	N(t-3)	N(t-0)	N(t-3)	N(t-0)	N(t-3)
Listing	-16,719	-20,079	-13,850***	-13,818***	-7,313***	-7,154***	-4,423***	-4,264***
	(132,500)	(152,810)	(4,070)	(4,457)	(1,719)	(1,782)	(955.2)	(954.5)
Post*Listing	15,192	18,834	13,746***	13,720***	7,263***	7,106***	4,393***	4,236***
	(132,542)	(152,770)	(4,059)	(4,445)	(1,713)	(1,776)	(951.7)	(951.0)
SOE	-396.3***	-396.9***	-37.54***	-37.51***	-17.47***	-17.40***	-9.805***	-9.736***
	(64.05)	(70.05)	(2.555)	(2.627)	(1.084)	(1.087)	(0.593)	(0.584)
Post* SOE	-1,028	-1,316	-33.26	-38.10	-12.04	-13.24	-5.821	-6.238
	(967.1)	(1,084)	(30.27)	(33.96)	(10.56)	(11.76)	(4.902)	(5.406)
Age	-0.0863*	-0.0869*	-0.0112**	-0.0112**	-0.00614***	-0.00615***	-0.00390***	-0.00391***
	(0.0516)	(0.0515)	(0.00480)	(0.00479)	(0.00234)	(0.00231)	(0.00136)	(0.00133)
Value-added	0.00667***	0.00667***	0.000188***	0.000187***	6.36e-05***	6.31e-05***	2.89e-05***	2.84e-05***
	(0.000667)	(0.000660)	(2.16e-05)	(2.16e-05)	(8.19e-06)	(8.11e-06)	(4.17e-06)	(4.08e-06)
Constant	1,507***	1,509***	160.3***	160.3***	78.62***	78.49***	46.27***	46.15***
	(118.1)	(134.5)	(4.813)	(5.192)	(2.134)	(2.225)	(1.197)	(1.219)
Observations	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774	2,003,774
R-squared	0.004	0.004	-0.097	-0.097	-0.199	-0.190	-0.308	-0.285
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. TFPQ is computed from TFPR by assuming sigma equal to different values, in which above sigma is set to be 3. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 4.14: Effects of Listing on TFPR and TFPQ with Potential Qualified Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	TFPR				TFPQ (Sigma=3)			
Instrument	N(t-0)	N(t-1)	N(t-2)	N(t-3)	N(t-0)	N(t-1)	N(t-2)	N(t-3)
Listing	-429.5***	-417.7***	-375.1***	-356.7***	-30,231	-30,774	-27,276	-27,072
	(134.0)	(131.8)	(117.1)	(109.8)	(22,460)	(22,724)	(21,250)	(19,869)
Post*Listing	423.4***	411.7***	369.6***	351.5***	30,659	31,267	27,945	27,930
	(132.7)	(130.4)	(115.9)	(108.7)	(22,128)	(22,381)	(20,904)	(19,510)
Age	-0.00230**	-0.00228**	-0.00221**	-0.00218**	-0.151	-0.152	-0.147	-0.147
	(0.00111)	(0.00110)	(0.00105)	(0.00103)	(0.130)	(0.131)	(0.129)	(0.129)
Value-added	1.96e-06***	1.92e-06***	1.74e-06***	1.67e-06***	0.00395***	0.00394***	0.00393***	0.00392***
	(5.85e-07)	(5.75e-07)	(5.13e-07)	(4.84e-07)	(0.000352)	(0.000352)	(0.000349)	(0.000348)
Constant	15.78***	15.76***	15.70***	15.68***	2,001***	2,002***	1,996***	1,994***
	(0.661)	(0.653)	(0.619)	(0.605)	(128.3)	(129.5)	(128.3)	(128.5)
Observations	224,306	224,306	224,306	224,306	224,306	224,306	224,306	224,306
R-squared	-0.501	-0.472	-0.375	-0.337	0.013	0.011	0.021	0.022
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. TFPQ is computed from TFPR by assuming sigma equal to different values, in which above sigma is set to be 3. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.15: Robustness Check of Effects of Listing on TFPQ with Potential Qualified Firms

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	TFPQ (sigma=5)		TFPQ (sigma=7)		TFPQ (sigma=10)	
Instrument	N(t-0)	N(t-3)	N(t-0)	N(t-3)	N(t-0)	N(t-3)
Listing	-4,336***	-3,679***	-2,100***	-1,767***	-1,205***	-1,009***
	(1,589)	(1,347)	(714.0)	(597.9)	(394.2)	(327.5)
Post*Listing	4,307***	3,665***	2,079***	1,752***	1,191***	998.1***
	(1,572)	(1,331)	(706.6)	(591.3)	(390.2)	(324.0)
Age	-0.0193	-0.0182	-0.00984*	-0.00929*	-0.00591*	-0.00558*
	(0.0118)	(0.0111)	(0.00554)	(0.00518)	(0.00315)	(0.00293)
Value-added	8.22e-05***	7.92e-05***	2.45e-05***	2.31e-05***	9.99e-06***	9.18e-06***
	(9.52e-06)	(8.72e-06)	(3.61e-06)	(3.17e-06)	(1.85e-06)	(1.58e-06)
Constant	167.1***	166.2***	77.52***	77.06***	43.92***	43.66***
	(8.095)	(7.694)	(3.569)	(3.340)	(1.955)	(1.811)
Observations	224,306	224,306	224,306	224,306	224,306	224,306
R-squared	-0.246	-0.170	-0.333	-0.229	-0.396	-0.270
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: N(t-0) refers to the number of investment bank of a city at the current year, and N(t-1) refers to the number of investment bank one-year lead. TFPQ is computed from TFPR by assuming sigma equal to different values, in which above sigma is set to be 3. All regressions passed the over-identification test, under-identification test and weak identification test. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4.16: Effects of Listing on Firm's Characteristics

(1)	(2)
Variables	Beta of Post*Listing
Assets	
(1) Total assets	Negative
(2) Fixed assets	Positive
(3) Production use of (2)	Positive
(4) Annual average of net fixed assets	Positive
(5) Intangible assets	Positive
(6) Current assets	Negative
(7) Accounts receivable	Negative
(8) Inventory	Negative
(9) Final goods of (8)	Negative
(10) Annual average of (6)	Negative
(11) Long-term investment	Positive
Liabilities	
(12) Total liabilities	Negative
(13) Long-term liabilities	Positive
(14) Current liabilities	Negative
Capital	
(15) Total equity	Not significant
(16) Paid-in capital	Negative
(17) State-owned capital	Positive
(18) Corporate capital	Positive
(19) Personal capital	Positive
(20) Hong Kong, Macao and Taiwan capital	Negative
(21) Foreign capital	Negative
Income, Profit and Cost	
(22) Sales value	Negative
(23) Export delivery value	Negative
(24) Main product sales revenue	Negative
(25) Sales profit	Not significant
(26) Other profit	Positive
(27) Operating profit	Positive
(28) Total loss	Negative
(29) Payable profit	Negative
(30) Main product sales cost	Negative
(31) Intermediate input	Negative
(32) Operating expenses	Negative
(33) Management cost	Negative
(34) Taxes and surcharges of (33)	Positive
(35) Property insurance of (33)	Not significant
(36) Financial expenses	Positive
(37) Interest expenses	Positive

Wages and Welfare	
(38) Total employment	Negative
(39) Total payroll payable	Negative
(40) Total wages payable for main business	Negative
(41) Total welfare payable	Negative
(42) Welfare payable for main business	Negative
(43) Unemployment insurance	Not significant
Taxes and Subsidies	
(44) Taxes for main business sales	Positive
(45) Total taxes	Positive
(46) Income tax payable	Positive
(47) VAT	Positive
(48) Input tax	Positive
(49) Output tax	Positive
(50) Subsidy	Not significant

Appendix A

A.1 Chapter 1 Appendix

A.1.1 Five Year Plans

The Five Year Plans are the most important industrial policies used to guide investment and economic activities in China. The Chinese central government issued the first Five Year Plan in 1953, which sought to promote different industries by making specific investment plans and establishing growth objectives for each industry. The first Five Year Plans sought to establish a variety of industries in China during a period when the economy was centrally controlled and closed. However, since the policy of "grasping the large and letting go of the small" was enacted in 1997, a movement towards privatization has taken place. Moreover, the Five Year Plans have shifted towards a more general outline regarding the investment and development aims for all industries. While the stated objective of these Five Year Plans is to provide guidance regarding economic development and investment in the following five years, it is unclear whether these policies have been successful in attaining their objectives. Whereas the policies are designed by the central government, local governments are in charge of the implementation.

As mentioned above, the Five Year Plans are proposed and approved by the State Council, which is the central Chinese government. However, given that the number of firms owned by the central government is small relative to the total number of firms in the economy, direct support to particular firms is limited.

Local governments at provincial, county, and district levels are the key to the completion of the Five Year Plans. Therefore, the central government urges local governments to support the target firms and industries. Local governments are asked to make regional development plans based on the Five Year Plan. The central government conducts mid-term and final examinations, and the results of these examination are used as one of the promotion indicators for local officers. Therefore, local governments have a clear incentive to support the target firms and industries using various methods such as fiscal and financial supports, tax reduction, selling products for firms, helping firms establish branches.

The natural question then to ask would be why are these industries supported by the 10th Five Year Plans? There is no direct evidence to show why are these industries supported, and the original official documents only give abstract reasons. The main theme for the development of manufacturing industries of the 10th Five Year Plan is to improve technology level by adopting the new technology advances of the new round world technology revolution, and to transform the economic structure. The Five Year Plan supports some industries of raw materials is because the industrial structure of these sectors needs to be optimized, which these industries include textile, paper and paper products manufacturing, and so on. Local governments are asked to help firms in these raw material industries to produce with less energy use and less pollution emission by adopting new high technology. Moreover, some high-tech sectors are supported by the 10th Five Year Plan is because of the improvement of technology level of foreign firms. For example, the official statement claims that equipment manufacturing is supported by the Five Year Plan is because the central government encourage these industries to adopt hi-tech from foreign firms. For some industries like satellite manufacturing, China has already had more advanced technology than most of other countries, the 10th Five Year Plan still supports it. In addition, some industries are supported since the very first Five Year Plan are also supported by the 10th Five Year Plan, such as steel and energy, because they are taken basic and important industries for economic development and national defense.

A.1.2 Anticipated Effects of the 10th Five Year Plan

If misallocation led to the support provided by the 10th Five Year Plan rather than vice versa, then the estimates discussed in the previous section would obscure this reverse causality. As we mentioned earlier, the descriptive statistics reported in 1 suggest that the Chinese government did not target industries that had more misallocation. Note how the mean of var(logTFPR) for supported and not supported industries was similar in the year 2000. This similarity is present in other measures of dispersion such as the interdecile range, $90^{th} – 10^{th}$, and the interquartile range, $75^{th} – 25^{th}$. Moreover, the aims expressed by the government for the 10^{th} Five Year Plan do not explicitly touch on the question of misallocation. Instead, the general objective was to foster economic growth and improve international competitiveness. To further explore this issue, A.4 reports estimates for the model in Equation (2.5) augmented with leads of the industrial policy. More precisely, we add indicator variables for one, 2000×Supported, and two, 1999×Supported, years before the adoption of the plan. The adoption leads are statistically insignificant, showing little evidence that the 10th Five Year Plan was anticipated by the industries it supported.

Table A.1.1: Supported and Not Supported Industries by Five Year Plans

4-digit code	Industry	By the 9th FYP	By the 10th FYP	< 10 in a single year
	Treated Group			
1310	Grain grinding	No	Yes	No
1320	Feed processing	No	Yes	No
1331	Edible vegeoil processing	No	Yes	No
1332	Non-edible vegeoil processing	No	Yes	No
1340	Sugar production	No	Yes	No
1391	Starch and starch products manufacturing	No	Yes	No
1392	Soy products manufacturing	No	Yes	No
1393	Egg processing	No	Yes	No
1399	Other agricultural and sideline products processing	No	Yes	No
1711	Cotton, chemical fiber textile processing	No	Yes	No
1712	Cotton, chemical fiber printing and dyeing finishing	No	Yes	No
1721	Top processing	No	Yes	No
1722	Wool textile	No	Yes	No
1723	Wool dyeing and finishing	No	Yes	No
1730	Hemp textile	No	Yes	No
1741	Reeling processing	No	Yes	No
1742	Silk spinning and silk processing	No	Yes	No
1743	Silk screen dyeing finishing	No	Yes	No
1751	Cotton and chemical fiber products manufacturing	No	Yes	No
1752	Wool products manufacturing	No	Yes	No
1753	Hemp products manufacturing	No	Yes	No
1754	Silk products manufacturing	No	Yes	No
1755	Rope and cable manufacturing	No	Yes	No
1756	Woven and cord fabric manufacturing	No	Yes	No
1759	Other textile products manufacturing	No	Yes	No
1761	Cotton, chemical fiber knitwear and fabricated products manufacturing	No	Yes	No
1762	Wool knitwear and fabricated products manufacturing	No	Yes	No
1763	Silk knitwear and fabricated products manufacturing	No	Yes	No
1769	Other knitwear and fabricated products manufacturing	No	Yes	No
1810	Textile and garment manufacturing	No	Yes	No
1910	Leather tanning processing	No	Yes	No
1931	Fur tanning processing	No	Yes	No
2210	Pulp manufacturing	No	Yes	No
2221	Mechanism paper and paperboard manufacturing	No	Yes	No
2223	Processed paper manufacturing	No	Yes	No
2231	Paper and cardboard containers manufacturing	No	Yes	No
2621	Nitrogen fertilizer manufacturing	No	Yes	No
2622	Phosphate fertilizer manufacturing	No	Yes	No
2623	Potash fertilizer manufacturing	No	Yes	No
2624	Compound fertilizer manufacturing	No	Yes	No

2625	Organic and microbial fertilizer manufacturing	No	Yes	No
2629	Other fertilizer manufacturing	No	Yes	No
2710	Chemical original drug manufacturing	No	Yes	No
2720	Chemical preparations manufacturing	No	Yes	No
2730	Chinese medicine Pieces processing	No	Yes	No
2760	Biological and biochemical products manufacturing	No	Yes	No
2770	Health materials and medical supplies manufacturing	No	Yes	No
2811	Chemical pulp manufacturing	No	Yes	No
2812	Man-made fiber manufacturing	No	Yes	No
2911	Vehicles, aircraft and machinery tires manufacturing	No	Yes	No
2912	Power tire manufacturing	No	Yes	No
2913	Tire refurbishment	No	Yes	No
2920	Rubber sheet, tube, and belt manufacturing	No	Yes	No
2930	Rubber parts manufacturing	No	Yes	No
2940	Recycled rubber manufacturing	No	Yes	No
2950	Daily and medical rubber products manufacturing	No	Yes	No
2960	Rubber boots manufacturing	No	Yes	No
2990	Other rubber products manufacturing	No	Yes	No
3010	Plastic film manufacturing	No	Yes	No
3020	Plastic plate, tube, and profile manufacturing	No	Yes	No
3030	Plastic wire, rope and knitwear manufacturing	No	Yes	No
3040	Foam manufacturing	No	Yes	No
3082	Daily plastic sundry goods manufacturing	No	Yes	No
3090	Other plastic products manufacturing	No	Yes	No
3111	Cement manufacturing	No	Yes	No
3513	Turbine and auxiliary equipment manufacturing	No	Yes	No
3615	Metallurgical equipment manufacturing	No	Yes	No
3641	Pulp and paper special equipment manufacturing	No	Yes	No
3653	Sewing machine manufacturing	No	Yes	No
3671	Tractor manufacturing	No	Yes	No
3672	Mechanized agricultural and gardening equipment manufacturing	No	Yes	No
3674	Animal husbandry machinery manufacturing	No	Yes	No
3675	Fishery machinery manufacturing	No	Yes	No
3676	Agricultural machinery accessories manufacturing	No	Yes	No
3679	Other agricultural machinery manufacturing	No	Yes	No
3711	Railway rolling stock and EMU manufacturing	No	Yes	No
3712	Special rail vehicles manufacturing	No	Yes	No
3713	Railway rolling stock accessories manufacturing	No	Yes	No
3714	Railway special equipment and accessories manufacturing	No	Yes	No
3719	Other railway equipment manufacturing and equipment repair	No	Yes	No
3751	Metal ship manufacturing	No	Yes	No
3752	Non-metallic ship manufacturing	No	Yes	No
3754	Marine equipment manufacturing	No	Yes	No
3755	Ship repair and shipbreaking	No	Yes	No

3761	Aircraft manufacturing and repair	No	Yes	No
4071	Home video equipment manufacturing	No	Yes	No
4072	Home audio equipment manufacturing	No	Yes	No
4090	Other electronic equipment manufacturing	No	Yes	No
	Control Group			
1351	Livestock and poultry slaughter	No	No	No
1352	Meat products and by-product processing	No	No	No
1361	Aquatic product freezing processing	No	No	No
1362	Dry processing of surimi products and aquatic products	No	No	No
1363	Aquatic feed manufacturing	No	No	No
1411	Pastry, bread making	No	No	No
1419	Biscuits and other baked goods manufacturing	No	No	No
1421	Candy, chocolate making	No	No	No
1422	Candied production making	No	No	No
1431	Rice and flour products manufacturing	No	No	No
1432	Frozen food manufacturing	No	No	No
1440	Liquid milk and dairy products manufacturing	No	No	No
1451	Meat and poultry canning	No	No	No
1452	Aquatic product canning	No	No	No
1453	Vegeand fruit canning	No	No	No
1459	Other foods canning	No	No	No
1461	MSG manufacturing	No	No	No
1462	Soy sauce, vinegar and similar products manufacturing	No	No	No
1469	Other condiments, fermented products manufacturing	No	No	No
1492	Frozen drinks and edible ice manufacturing	No	No	No
1493	Salt processing	No	No	No
1494	Food and feed additive manufacturing	No	No	No
1499	Other unspecified food manufacturing	No	No	No
1510	Alcohol manufacturing	No	No	No
1521	Liquor manufacturing	No	No	No
1522	Beer manufacturing	No	No	No
1523	Yellow wine manufacturing	No	No	No
1524	Wine making	No	No	No
1529	Other wine making	No	No	No
1531	Carbonated beverage manufacturing	No	No	No
1532	Bottle (can) drinking water manufacturing	No	No	No
1533	Fruit and vegejuice and fruit and vegejuice beverage manufacturing	No	No	No
1535	Solid beverage manufacturing	No	No	No
1539	Tea beverages and other soft drink manufacturing	No	No	No
1540	Refined tea processing	No	No	No
1610	Tobacco leaf re-baking	No	No	No
1620	Cigarette manufacturing	No	No	No
1690	Other tobacco products processing	No	No	No
1820	Textile shoes manufacturing	No	No	No

1830	Cap manufacturing	No	No	No
1921	Leather shoes manufacturing	No	No	No
1922	Leather garment manufacturing	No	No	No
1923	Luggage, bag manufacturing	No	No	No
1929	Other leather products manufacturing	No	No	No
1932	Fur garment processing	No	No	No
1939	Other fur products processing	No	No	No
1941	Feather (velvet) processing	No	No	No
1942	Feather (velvet) products processing	No	No	No
2011	Sawn processing	No	No	No
2012	Wood chip processing	No	No	No
2021	Plywood manufacturing	No	No	No
2022	Fiberboard manufacturing	No	No	No
2023	Particleboard manufacturing	No	No	No
2029	Other wood-based panels and materials manufacturing	No	No	No
2031	Construction timber and wood component processing	No	No	No
2032	Wood container manufacturing	No	No	No
2039	Cork products and other wood products manufacturing	No	No	No
2040	Bamboo, rattan, palm and grass products manufacturing	No	No	No
2110	Wooden furniture manufacturing	No	No	No
2120	Bamboo and rattan furniture manufacturing	No	No	No
2130	Metal furniture manufacturing	No	No	No
2190	Other furniture manufacturing	No	No	No
2311	Book, newspaper, publication	No	No	No
2312	Booklet printing	No	No	No
2319	Packaging and other printing	No	No	No
2320	Binding and other printing service activities	No	No	No
2330	Copy of recording medium	No	No	No
2411	Stationery manufacturing	No	No	No
2412	Pen manufacturing	No	No	No
2413	Teaching model and teaching aid manufacturing	No	No	No
2419	Other stationery manufacturing	No	No	No
2421	Ball manufacturing	No	No	No
2422	Sports equipment and accessories manufacturing	No	No	No
2431	Chinese musical instrument manufacturing	No	No	No
2432	Western musical instrument manufacturing	No	No	No
2433	Electronic musical instrument manufacturing	No	No	No
2439	Other instruments and parts manufacturing	No	No	No
2440	Toy manufacturing	No	No	No
2451	Open-air playground amusement equipment manufacturing	No	No	No
2452	Entertainment and indoor amusement equipment manufacturing	No	No	No
2611	Inorganic acid manufacturing	No	No	No
2612	Inorganic alkali manufacturing	No	No	No
2613	Inorganic salt manufacturing	No	No	No

2614	Organic chemical raw material manufacturing	No	No	No
3112	Lime and gypsum manufacturing	No	No	No
3121	Cement product manufacturing	No	No	No
3122	Structural component manufacturing	No	No	No
3123	Asbestos cement products manufacturing	No	No	No
3124	Lightweight building materials manufacturing	No	No	No
3129	Other cement products manufacturing	No	No	No
3131	Clay brick and building block manufacturing	No	No	No
3133	Construction stone processing	No	No	No
3134	Waterproof building materials manufacturing	No	No	No
3135	Insulation and sound insulation materials manufacturing	No	No	No
3139	Other building materials manufacturing	No	No	No
3141	Flat glass manufacturing	No	No	No
3142	Technical glass manufacturing	No	No	No
3143	Optical glass manufacturing	No	No	No
3144	Glass instrument manufacturing	No	No	No
3145	Daily glass products and glass packaging containers manufacturing	No	No	No
3147	Glass fiber and related product manufacturing	No	No	No
3148	Glass fiber reinforced plastic products manufacturing	No	No	No
3149	Other glass products manufacturing	No	No	No
3151	Sanitary ceramics manufacturing	No	No	No
3153	Daily ceramics manufacturing	No	No	No
3159	Gardening, furnishings and other ceramic products manufacturing	No	No	No
3161	Asbestos manufacturing	No	No	No
3162	Mica product manufacturing	No	No	No
3169	Refractory ceramics and other refractory materials manufacturing	No	No	No
3191	Graphite and carbon products manufacturing	No	No	No
3199	Other non-metallic mineral products manufacturing	No	No	No
3240	Ferroalloy smelting	No	No	No
3411	Metal structure manufacturing	No	No	No
3412	Metal door and window manufacturing	No	No	No
3421	Cutting tool manufacturing	No	No	No
3422	Hand tool manufacturing	No	No	No
3423	Metal tools for agricultural and garden use manufacturing	No	No	No
3424	Knives and scissors and similar daily metal tools manufacturing	No	No	No
3429	Other metal tool manufacturing	No	No	No
3431	Container manufacturing	No	No	No
3432	Metal pressure vessel manufacturing	No	No	No
3440	Wire rope and its products manufacturing	No	No	No
3452	Building decoration and plumbing pipe parts manufacturing	No	No	No
3453	Safety and fire metal products manufacturing	No	No	No
3459	Other construction and safety metal products manufacturing	No	No	No
3460	Metal surface treatment and heat treatment processing	No	No	No
3481	Metal kitchen conditioning and sanitary appliance manufacturing	No	No	No

3482	Metal kitchen utensils and tableware manufacturing	No	No	No
3489	Other daily metal products manufacturing	No	No	No
3511	Boiler and auxiliary equipment manufacturing	No	No	No
3512	Internal combustion engine and accessories manufacturing	No	No	No
3514	Turbine and auxiliary machinery manufacturing	No	No	No
3519	Other prime mover manufacturing	No	No	No
3530	Lifting transport equipment manufacturing	No	No	No
3551	Bearing manufacturing	No	No	No
3552	Gear, transmission and drive component manufacturing	No	No	No
3560	Oven, furnace and electric furnace manufacturing	No	No	No
3571	Fan manufacturing	No	No	No
3573	Refrigeration and air conditioning equipment manufacturing	No	No	No
3574	Pneumatic and power tool manufacturing	No	No	No
3575	Spray guns and similar appliances manufacturing	No	No	No
3577	Weighing instrument manufacturing	No	No	No
3579	Other general equipment manufacturing	No	No	No
3582	Fasteners, spring manufacturing	No	No	No
3583	Mechanical parts processing and equipment repair	No	No	No
3589	Other general parts manufacturing	No	No	No
3591	Steel casting manufacturing	No	No	No
3592	Forgings and powder metallurgy products manufacturing	No	No	No
3611	Mining and quarrying equipment manufacturing	No	No	No
3612	Oil drilling and mining equipment manufacturing	No	No	No
3613	Construction machinery manufacturing	No	No	No
3614	Special machinery manufacturing for building materials production	No	No	No
3622	Rubber processing equipment manufacturing	No	No	No
3623	Plastic processing equipment manufacturing	No	No	No
3624	Wood processing machinery manufacturing	No	No	No
3625	Mold making	No	No	No
3631	Special equipment manufacturing for food, beverage and tobacco industry	No	No	No
3632	Manufacturing of special equipment for agricultural and sideline food processing	No	No	No
3633	Special equipment manufacturing for feed production	No	No	No
3642	Printing equipment manufacturing	No	No	No
3643	Daily use chemical equipment manufacturing	No	No	No
3644	Pharmaceutical special equipment manufacturing	No	No	No
3645	Special equipment for lighting equipment production manufacturing	No	No	No
3646	Manufacture of special equipment for the production of glass, ceramics and enamel products	No	No	No
3661	Electrical machinery special equipment manufacturing	No	No	No
3669	Aviation, aerospace and other specialized equipment manufacturing	No	No	No
3681	Medical diagnostic, monitoring and treatment equipment manufacturing	No	No	No
3683	Laboratory and medical disinfection equipment and apparatus manufacturing	No	No	No
3684	Medical, surgical and veterinary equipment manufacturing	No	No	No
3686	Prosthetics, artificial organs and implants manufacturing	No	No	No

3689	Other medical equipment manufacturing	No	No	No
3691	Special equipment for environmental pollution prevention and control	No	No	No
3692	Geological exploration special equipment manufacturing	No	No	No
3694	Manufacturing of special equipment for business, catering and service industries	No	No	No
3695	Social public safety related equipment manufacturing	No	No	No
3697	Water resources special machinery manufacturing	No	No	No
3699	Other special equipment manufacturing	No	No	No
3731	Motorcycle manufacturing	No	No	No
3732	Motorcycle parts and accessories manufacturing	No	No	No
3741	Bicycle and disabled wheelchair manufacturing	No	No	No
3951	Household refrigeration electric appliance manufacturing	No	No	No
3952	Household air conditioner manufacturing	No	No	No
3953	Household ventilation electrical appliance manufacturing	No	No	No
3954	Household kitchen appliances manufacturing	No	No	No
3955	Household cleaning and sanitary appliance manufacturing	No	No	No
3956	Home beauty, health care appliance manufacturing	No	No	No
3961	Manufacture of gas, solar and similar energy appliances	No	No	No
3969	Other non-power household appliances manufacturing	No	No	No
3971	Electric light source manufacturing	No	No	No
3972	Lighting fixture manufacturing	No	No	No
3979	Lamp electrical accessories and other lighting equipment manufacturing	No	No	No
3991	Vehicle-specific lighting and electrical signal equipment manufacturing	No	No	No
3999	Other unspecified electrical machinery manufacturing	No	No	No
4031	Radio and television program production and launch equipment manufacturing	No	No	No
4153	Camera and equipment manufacturing	No	No	No
4154	Copy and offset printing equipment manufacturing	No	No	No
4155	Calculator and currency equipment manufacturing	No	No	No
4159	Other cultural and office machinery manufacturing	No	No	No
4190	Other instruments manufacturing and repairs	No	No	No
4211	Sculpture crafts manufacturing	No	No	No
4212	Metal crafts manufacturing	No	No	No
4213	Lacquer crafts manufacturing	No	No	No
4214	Flower painting crafts manufacturing	No	No	No
4215	Natural plant weaving crafts manufacturing	No	No	No
4216	Drawn work embroidery crafts manufacturing	No	No	No
4217	Carpet and tapestries manufacturing	No	No	No
4218	Jewelry and related items manufacturing	No	No	No
4219	Other arts and crafts manufacturing	No	No	No
4221	Mirror and similar products processing	No	No	No
4222	Bristles, brushes and cleaning tools manufacturing	No	No	No
4229	Other daily sundries manufacturing	No	No	No
4219	Other arts and crafts manufacturing	No	No	No
4221	Mirror and similar products processing	No	No	No
4222	Bristles, brushes and cleaning tools manufacturing	No	No	No

Dropped Group 1 - out of less than 10 observations in a single year				
2222	Handmade paper manufacturing	No	Yes	Yes
3673	Forest and wood bamboo cutting machinery manufacturing	No	Yes	Yes
3759	Navigation equipment and other floating devices manufacturing	No	Yes	Yes
4151	Film machinery manufacturing	No	No	Yes
4152	Slide and projection equipment manufacturing	No	No	Yes
1364	Fish oil extraction and product manufacturing	No	No	Yes
1491	Nutrition and health food manufacturing	No	No	Yes
2140	Plastic furniture manufacturing	No	No	Yes
3491	Laboratory supplies for coinage and precious metals manufacturing	No	No	Yes
3693	Special postal machinery and equipment manufacturing	No	No	Yes
3792	Metal signage and facility for traffic menagement manufacturing	No	No	Yes
1369	Other aquatic products processing	No	No	Yes
1370	Vegetable, fruit and nut processing	No	No	Yes
1439	Instant noodles and other convenience food manufacturing	No	No	Yes
1534	Milk beverage and vegeprotein beverage manufacturing	No	No	Yes
1924	Leather gloves and leather decorative products manufacturing	No	No	Yes
2414	Ink manufacturing	No	No	Yes
2423	Training fitness equipment manufacturing	No	No	Yes
2424	Sports protective equipment manufacturing	No	No	Yes
2429	Other sporting goods manufacturing	No	No	Yes
2530	Nuclear fuel processing	No	No	Yes
2619	Other basic chemical raw material manufacturing	No	No	Yes
3132	Building ceramics manufacturing	No	No	Yes
3146	Glass insulation container manufacturing	No	No	Yes
3152	Special ceramics manufacturing	No	No	Yes
3321	Gold smelting	No	No	Yes
3322	Silver smelting	No	No	Yes
3329	Other precious metal smelting	No	No	Yes
3352	Precious metal calendering	No	No	Yes
3433	Metal packaging container manufacturing	No	No	Yes
3451	Manufacture of metal parts for construction and furniture	No	No	Yes
3471	Manufacture of enamel products for industrial production	No	No	Yes
3472	Enamel sanitary ware manufacturing	No	No	Yes
3479	Manufacture of enamel daily necessities and other enamel products	No	No	Yes
3499	Other unspecified metal products manufacturing	No	No	Yes
3572	Gas, liquid separation and pure equipment manufacturing	No	No	Yes
3649	Manufacture of special equipment for the production of other daily necessities	No	No	Yes
3663	Weapons and ammunition manufacturing	No	No	Yes
3682	Dental equipment and equipment manufacturing	No	No	Yes
3685	Mechanical treatment and ward care equipment manufacturing	No	No	Yes
3696	Traffic safety and control special equipment manufacturing	No	No	Yes
3742	Movable bicycle manufacturing	No	No	Yes
3791	Diving and underwater salvage equipment manufacturing	No	No	Yes

3799	Other transportation equipment manufacturing	No	No	Yes
3957	Manufacture of accessories for household electrical appliances	No	No	Yes
3959	Other household electrical appliance manufacturing	No	No	Yes
4032	Radio and television receiving equipment manufacturing	No	No	Yes
4039	Application of television equipment and other radio and television equipment manufacturing	No	No	Yes
4230	Coal product manufacturing	No	No	Yes
4240	Nuclear radiation processing	No	No	Yes
4290	Other unspecified manufacturing	No	No	Yes
4320	Non-metallic scrap and debris processing	No	No	Yes
1757	Nonwovens manufacturing	No	Yes	Yes
2239	Other paper products manufacturing	No	Yes	Yes
2740	Chinese medicine manufacturing	No	Yes	Yes
2750	Veterinary drugs manufacturing	No	Yes	Yes
3050	Plastic leather, synthetic leather manufacturing	No	Yes	Yes
3060	Plastic crates and containers manufacturing	No	Yes	Yes
3070	Plastic parts manufacturing	No	Yes	Yes
3081	Plastic shoes manufacturing	No	Yes	Yes
3651	Textile special equipment manufacturing	No	Yes	Yes
3652	Leather, fur and their products processing equipment manufacturing	No	Yes	Yes
3659	Other clothing processing special equipment manufacturing	No	Yes	Yes
3753	Recreational and sports ship manufacturing and repair	No	Yes	Yes
3762	Spacecraft manufacturing	No	Yes	Yes
3769	Other spacecraft manufacturing	No	Yes	Yes
	Dropped Group 2 - out of supported by the 9th Five Year Plan			
2631	Chemical pesticide manufacturing	Yes	Yes	No
2632	Bio and microbial chemical pesticide manufacturing	Yes	Yes	No
2641	Paint manufacturing	Yes	Yes	No
2642	Ink and ink similar products manufacturing	Yes	Yes	No
2643	Pigment manufacturing	Yes	Yes	No
2644	Dye manufacturing	Yes	Yes	No
2645	Seal packing and similar products manufacturing	Yes	Yes	No
2651	Primary form of plastic and synthetic resin manufacturing	Yes	Yes	No
2652	Synthetic rubber manufacturing	Yes	Yes	No
2653	Synthetic fiber monomer (polymer) manufacturing	Yes	Yes	No
2659	Other synthetic materials manufacturing	Yes	Yes	No
2661	Chemical reagents and additives manufacturing	Yes	Yes	No
2662	Special chemical products manufacturing	Yes	Yes	No
2663	Forest chemical products manufacturing	Yes	Yes	No
2664	Explosives and pyrotechnic products manufacturing	Yes	Yes	No
2665	Information chemical manufacturing	Yes	Yes	No
2666	Special pharmaceutical materials for pollution treatment manufacturing	Yes	Yes	No
2667	Animal glue manufacturing	Yes	Yes	No
2669	Other special chemical products manufacturing	Yes	Yes	No

2671	Soap and synthetic detergent manufacturing	Yes	Yes	No
2672	Cosmetics manufacturing	Yes	Yes	No
2673	Oral cleaning supplies manufacturing	Yes	Yes	No
2674	Spices and fragrance manufacturing	Yes	Yes	No
2679	Other daily chemical products manufacturing	Yes	Yes	No
2821	Nylon fiber manufacturing	Yes	Yes	No
2822	Polyester fiber manufacturing	Yes	Yes	No
2823	Acrylic fiber manufacturing	Yes	Yes	No
2824	Vinylon fiber manufacturing	Yes	Yes	No
2829	Other synthetic fibers manufacturing	Yes	Yes	No
3210	Ironmaking	Yes	Yes	No
3220	Steelmaking	Yes	Yes	No
3230	Steel calendaring	Yes	Yes	No
3316	Aluminum smelting	Yes	Yes	No
3331	Tungsten molybdenum smelting	Yes	Yes	No
3332	Rare earth metal smelting	Yes	Yes	No
3339	Other rare earth metal smelting	Yes	Yes	No
3521	Metal cutting machine tools manufacturing	Yes	Yes	No
3522	Metal forming machine manufacturing	Yes	Yes	No
3523	Casting machinery manufacturing	Yes	Yes	No
3524	Metal cutting and welding equipment manufacturing	Yes	Yes	No
3525	Machine tool accessories manufacturing	Yes	Yes	No
3529	Other metal processing machinery manufacturing	Yes	Yes	No
3621	Refining, chemical production equipment manufacturing	Yes	Yes	No
3721	Automobile vehicle manufacturing	Yes	Yes	No
3722	Car modification	Yes	Yes	No
3723	Tram manufacturing	Yes	Yes	No
3724	Car body and trailer manufacturing	Yes	Yes	No
3725	Auto parts and accessories manufacturing	Yes	Yes	No
3726	Car repair	Yes	Yes	No
3911	Generators and generator sets manufacturing	Yes	Yes	No
3912	Motor manufacturing	Yes	Yes	No
3919	Micro motor and other motor manufacturing	Yes	Yes	No
3921	Transformers, rectifiers and inductors manufacturing	Yes	Yes	No
3922	Capacitors and ancillary equipment manufacturing	Yes	Yes	No
3923	Distribution switch control equipment manufacturing	Yes	Yes	No
3924	Power electronic components manufacturing	Yes	Yes	No
3929	Other transmission and control equipment manufacturing	Yes	Yes	No
3931	Wire and cable equipment manufacturing	Yes	Yes	No
3932	Fiber optic cable manufacturing	Yes	Yes	No
3933	Insulating products manufacturing	Yes	Yes	No
3939	Other electrical equipment manufacturing	Yes	Yes	No
3940	Battery manufacturing	Yes	Yes	No
4041	Electronic computer manufacturing	Yes	Yes	No

4042	Computer network equipment manufacturing	Yes	Yes	No
4043	External equipment for electronic computer manufacturing	Yes	Yes	No
4051	Electronic vacuum devices manufacturing	Yes	Yes	No
4052	Semiconductor discrete devices manufacturing	Yes	Yes	No
4053	Integrated circuit manufacturing	Yes	Yes	No
4059	Optoelectronic and other electronic devices manufacturing	Yes	Yes	No
4061	Electronic components manufacturing	Yes	Yes	No
4062	Printed circuit board manufacturing	Yes	Yes	No
4111	Industrial automatic control system manufacturing	Yes	Yes	No
4112	Electrical instrumentation manufacturing	Yes	Yes	No
4113	Drawing, calculation and measurement equipment manufacturing	Yes	Yes	No
4114	Experimental analysis equipment manufacturing	Yes	Yes	No
4115	Testing machine manufacturing	Yes	Yes	No
4119	Instruments and other general equipment manufacturing	Yes	Yes	No
4121	Special instrument for environmental monitoring manufacturing	Yes	Yes	No
4122	Counting instrument for car and others manufacturing	Yes	Yes	No
4123	Navigation, meteorological and marine special equipment manufacturing	Yes	Yes	No
4124	Special instrumentation for agriculture manufacturing	Yes	Yes	No
4125	Geological exploration and seismic equipment manufacturing	Yes	Yes	No
4126	Teaching special equipment manufacturing	Yes	Yes	No
4127	Nuclear and nuclear radiation measuring instruments manufacturing	Yes	Yes	No
4128	Electronic measuring instruments manufacturing	Yes	Yes	No
4129	Other special equipment manufacturing	Yes	Yes	No
4130	Watches and clock equipment manufacturing	Yes	Yes	No
4141	Optical instruments manufacturing	Yes	Yes	No
4142	Glasses manufacturing	Yes	Yes	No
2511	Crude oil processing and petroleum products manufacturing	Yes	No	No
2512	Artificial crude oil manufacturing	Yes	No	No
2520	Coking	Yes	No	No
3311	Copper smelting	Yes	No	No
3312	Lead and zinc smelting	Yes	No	No
3313	Nickel and cobalt smelting	Yes	No	No
3314	Tin smelting	Yes	No	No
3315	Antimony smelting	Yes	No	No
3317	Magnesium smelting	Yes	No	No
3319	Other commonly used non-ferrous metal smelting	Yes	No	No
3340	Non-ferrous metal alloy manufacturing	Yes	No	No
3351	Common non-ferrous metal rolling processing	Yes	No	No
3353	Rare earth metal rolling processing	Yes	No	No
3541	Pump and vacuum equipment manufacturing	Yes	No	No
3542	Gas compression machinery manufacturing	Yes	No	No
3543	Valves and cocks manufacturing	Yes	No	No
3544	Hydraulic and pneumatic power machinery and component manufacturing	Yes	No	No
3576	Packing equipment manufacturing	Yes	No	No

3581	Metal seal manufacturing	Yes	No	No
3629	Other non-metal processing equipment manufacturing	Yes	No	No
3662	Special equipment for electronics manufacturing	Yes	No	No
4011	Communication transmission equipment manufacturing	Yes	No	No
4012	Communication switching equipment manufacturing	Yes	No	No
4013	Communication terminal equipment manufacturing	Yes	No	No
4014	Mobile communication and terminal equipment manufacturing	Yes	No	No
4019	Other communication equipment manufacturing	Yes	No	No
4020	Radar and ancillary equipment manufacturing	Yes	No	No
4310	Metal scrap and debris manufacturing	Yes	No	No

Note: There are 482 industries in total, of which 117 are supported by the 9th Five Year Plan and 365 are not. Moreover, 66 industries have less than 10 firms in a single year, so there are 299 industries in the sample, of which there are 88 industries that are supported by the 10th Five Year Plan and 211 are not.

Table A.1.2: Effects of the 10th Five Year Plan on the Dispersions of TFPR

	OLS			WLS		
Variables	V(TFPR)	90th -10th	75th -25th	V(TFPR)	90th -10th	75th -25th
	(1)	(2)	(3)	(4)	(5)	(6)
Post2000	0.0124*	.01008	.01582*	0.000392	-.0098	.00083
	(0.00641)	.01464	.00895	(0.0106)	.0252	.01601
Supported	-0.0138	-.03707	-.03542	-0.0294	-.06602	-.0415
	(0.0255)	.05876	.03186	(0.0457)	.10327	.05314
Post2000 × Supported	0.0280**	.06955**	.04361***	0.0649***	.14952***	.09537
	(0.0120)	.02849	.01676	(0.0171)	.03928	.02453
Constant	0.422***	1.5807***	.78658***	0.449***	1.6307***	.80446
	(0.0144)	.0315	.0172	(0.0228)	.05286	.02641
R-squared	0.003	0.0017	0.0038	0.009	0.0088	0.0145

Notes: V(TFPR) denotes the variance of log(TFPR). Post2000 is the period dummy that takes the value one if the year is after 2000. Supported is a dummy that takes one if the industry is supported by the 10th Five Year Plan. Mean (Age), Mean (Export/VA) and Mean (SOE share) denote the industry's average age, export/value-added and state-owned enterprise share, respectively. WLS regressions are weighted by the industry's share of value-added. The number of industry-year observations in all regressions is 2,392. Standard errors clustered at the 4-digit industry level are reported in parentheses. Statistical significance at the 1%, 5% and 10% are denoted by ***, ** and *, respectively

Table A.1.3: Effects of the 10^{th} Five Year Plan on the Dispersion of TFPR, Controlling for the Variance of Firms' Characteristics

VARIABLES	OLS			WLS		
	V(TFPR)	90^{th} -10^{th}	75^{th} -25^{th}	V(TFPR)	90^{th} -10^{th}	75^{th} -25^{th}
	(1)	(2)	(3)	(4)	(5)	(6)
Post2000	0.0513***	0.0929***	0.0455***	0.0663**	0.130**	0.0594*
	(0.0136)	(0.0298)	(0.0165)	(0.0287)	(0.0634)	(0.0336)
Supported	-0.0189	-0.0482	-0.0388	-0.0461	-0.104	-0.0610
	(0.0241)	(0.0554)	(0.0303)	(0.0412)	(0.0939)	(0.0501)
Post2000×	0.0328**	0.0819***	0.0506***	0.0860***	0.196***	0.115***
Supported	(0.0130)	(0.0299)	(0.0176)	(0.0260)	(0.0575)	(0.0317)
V(Age)	-0.000272***	-0.000690***	-0.000422***	-0.000220*	-0.000506*	-0.000323**
	(8.80e-05)	(0.000198)	(0.000106)	(0.000120)	(0.000305)	(0.000150)
V(Export/VA)	-8.23e-07***	-2.62e-06***	-1.32e-06***	-8.61e-07***	-2.70e-06***	-1.38e-06***
	(1.92e-07)	(4.71e-07)	(2.27e-07)	(2.82e-07)	(6.74e-07)	(3.50e-07)
V(SOE share)	0.722***	1.625***	0.707***	1.194***	2.583***	1.150***
	(0.165)	(0.376)	(0.197)	(0.276)	(0.647)	(0.347)
Constant	0.362***	1.462***	0.757***	0.319***	1.359***	0.705***
	(0.0240)	(0.0532)	(0.0289)	(0.0403)	(0.0920)	(0.0496)
R-squared	0.032	0.034	0.030	0.082	0.079	0.060

Notes: V(TFPR) denotes the variance of log(TFPR). 90^{th} -10^{th} and 75^{th} -25^{th} denote the difference in log(TFPR) values between the 90^{th} and the 10^{th} percentile and between the 75^{th} and the 25^{th} percentile, respectively. Post2000 is the period dummy that takes the value one if the year is after 2000. Supported is a dummy that takes one if the industry is supported by the 10^{th} Five Year Plan. Mean (Age), Mean (Export/VA) and Mean (SOE share) denote industry's average age, export/value-added and state-owned enterprise share, respectively. WLS regressions are weighted by the industry's share of value-added. The number of industry-year observations in all regressions is 2,392. Standard errors clustered at the 4-digit industry level are reported in parentheses. Statistical significance at the 1%, 5% and 10% are denoted by ***, ** and *, respectively

Table A.1.4: Anticipated Effects of the 10th Five Year Plan on the Variance of TFPR

Variables	OLS			WLS		
	V(TFPR)			V(TFPR)		
	(1)	(2)	(3)	(4)	(5)	(6)
Supported × 1999	-.000369	0.000468	-.000135	-0.0426	-0.0445	-0.0438
	(0.0157)	(0.0158)	(0.0156)	(0.0386)	(0.0393)	(0.0390)
Supported × 2000	0.0164	0.0168	0.0175	0.00248	-0.000845	0.000265
	(0.0162)	(0.0163)	(0.0162)	(0.0322)	(0.0334)	(0.0332)
Post2000×Supported	0.0333**	0.0310*	0.0333**	0.0327	0.0201	0.0266
	(0.0160)	(0.0160)	(0.0157)	(0.0238)	(0.0267)	(0.0250)
Mean(Age)		-0.0038**			-0.00418	
		(0.00188)			(0.00277)	
Mean(Export/VA)		-0.00128			-0.00161	
		(0.00138)			(0.00169)	
Mean(SOE share)		-0.0502			-0.153	
		(0.0810)			(0.135)	
V(Age)			3.84e-05			0.000264**
			(7.91e-05)			(0.000117)
V(Export/VA)			-2.3e-7***			-3.1e-7***
			(3.65e-08)			(7.62e-08)
V(SOE share)			-0.198			-0.519***
			(0.123)			(0.152)
Constant	0.858***	0.950***	0.894***	0.850***	0.996***	0.897***
	(0.0105)	(0.0328)	(0.0315)	(0.0177)	(0.0473)	(0.0386)
R-squared	0.856	0.858	0.857	0.904	0.907	0.906

Notes: V(TFPR) denotes the variance of log(TFPR). WLS regressions are weighted by the industry's share of value-added. Post2000 is the period dummy that takes the value one if the year is after 2000. Supported is a dummy that takes one if the industry is supported by the 10th Five Year Plan. Mean (Age), Mean (Export/VA) and Mean (SOE share) denote industry's average age, export/value-added and state-owned enterprise share respectively. V (Age), V (Export/VA) and V (SOE share) denote industry's variance of age, export/value-added and state-owned enterprise share, respectively. In all regressions, policy change dummies 1999 to 2000 are equal to one in only 1 year each per supported industry. Supported × Post2000 dummy is equal to one in every year after the issue of the Five Year Plan. The year 1998 is omitted. The number of industry-year observations in all regressions is 2,392. Standard errors clustered at the 4-digit industry level are reported in parentheses. Statistical significance at the 1%, 5% and 10% are denoted by ***, ** and *, respectively.

Table A.1.5: Effects of the Five Year Plan on Mean of TFPR and TFPQ

	OLS		WLS	
Variables	M(TFPR)	M(TFPQ)	M(TFPR)	M(TFPQ)
	(1)	(2)	(3)	(4)
Post2000	0.111***	0.274***	0.129***	0.323***
	(0.0105)	(0.0136)	(0.0215)	(0.0595)
Supported	-0.0630	0.0200	-0.181	-0.310
	(0.0398)	(0.0492)	(0.134)	(0.318)
Post2000 × Supported	0.0519**	0.0385	0.0730**	-0.00191
	(0.0204)	(0.0261)	(0.0359)	(0.0686)
Constant	1.619***	5.694***	1.752***	6.150***
	(0.0207)	(0.0298)	(0.122)	(0.312)
R-squared	0.031	0.080	0.053	0.061

Notes: M (TFPR) and M(TFPQ) denote the mean of log(TFPR) and log(TFPQ), respectively. Post2000 is the period dummy that takes the value one if the year is after 2000. Supported is a dummy that takes one if the industry is supported by the 10^{th} Five Year Plan. Mean (Age), Mean (Export/VA) and Mean (SOE share) denote industry's average age, export/value-added and state-owned enterprise share, respectively. WLS regressions are weighted by the industry's share of value-added. The number of industry-year observations in all regressions is 2,392. Standard errors clustered at the 4-digit industry level are reported in parentheses. Statistical significance at the 1%, 5% and 10% are denoted by ***, ** and *, respectively

Table A.1.6: Effects of the Five Year Plan on Taxes, Subsidies and Interest Payments

Variables	Tax Dummy	Tax/Value-added	Subsidy Dummy	Subsidy/Value-added	Interest Payment	Interest/Debt
	Probit	Tobit	Probit	Tobit	Ordered probit	OLS
	(1)	(2)	(3)	(4)	(5)	(6)
Post2000	0.113***	-0.00331	0.203***	0.185***	-0.204***	-0.00609*
	(0.0176)	(0.00267)	(0.0153)	(0.0220)	(0.0135)	(0.00347)
Supported	-0.185**	-0.0309***	0.0464	0.0393	0.125*	-0.000441
	(0.0762)	(0.00947)	(0.0445)	(0.0429)	(0.0648)	(0.00359)
Post2000 ×	0.0747**	0.0135***	0.0259	0.0297	-0.0368	0.0153
Supported	(0.0304)	(0.00437)	(0.0352)	(0.0367)	(0.0246)	(0.0116)
Age	0.0124***	0.000798***	0.00678***	0.00681***	0.0121***	-0.000218*
	(0.00145)	(0.000195)	(0.000773)	(0.000824)	(0.000691)	(0.000111)
Export	-0.601***	-0.0595***	0.282***	0.224***	-0.134***	-0.0218***
	(0.0452)	(0.00726)	(0.0366)	(0.0474)	(0.0295)	(0.00757)
State-owned	-0.0548	0.0118*	0.205***	0.257***	-0.205***	-0.0287***
	(0.0597)	(0.00666)	(0.0326)	(0.0384)	(0.0398)	(0.00495)
Constant	0.818***	0.00968	-1.535***	-1.772***		
	(0.0324)	(0.00756)	(0.0212)	(0.173)		
Cut-point 1					-1.538***	
					(0.0240)	
Cut-point 2					-0.493***	
					(0.0223)	
Sigma		0.235***		1.113***		
		(0.0304)		(0.105)		
Observations	902,175	902,175	902,175	902,175	902,175	902,175
Cluster	Industry	Industry	Industry	Industry	Industry	Industry

Notes: The tax dummy equals 1 if a firm pays taxes, 0 otherwise. The subsidy dummy equals 1 if a firm receives subsidies, 0 otherwise. Interest Payment takes the value of 1 if the firm receives interest payments, 2 if it does not receive nor pay interests, and 2 if it pays interests. Interests/Debt is the ratio of a firm's interest payment to total liabilities. Export is a dummy that equals 1 if a firm exports, 0 otherwise. State-owned is a dummy that equals to 1 if a firm is state-owned, otherwise 0. Significance levels are denoted by *** p<0.01, ** p<0.05, * p<0.1

Table A.1.7: Effects of the Five Year Plan on Taxes, Subsidies and Interest Payments

	Probit		Tobit		Probit		Tobit		Ordered Probit		OLS	
VARIABLES	Tax Dummy		Tax/Value-added		Subsidy Dummy		Subsidy/Value-added		Applied Interest Rate Dummy		Applied Interest Rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post2000×Supported	.0642***	.0642***	.00755***	0.00755***	0.0563	0.0563***	0.0561	0.0561***	-0.0144**	-0.0144	.0198	.0198
	(0.00670)	(0.0229)	(0.00113)	(0.00266)	(.0405)	(.00789)	(.0398)	(.00878)	(.00605)	(0.0213)	(.01459)	(.01358)
Age	.0103***	.0103***	.000516***	.000516***	.00662***	.00662***	.00663***	.00663***	0.0110***	0.0110***	-.0002	-.0002
	(.00016)	(.00107)	(2.36e-05)	(.000107)	(.000472)	(.000155)	(.000679)	(.000171)	(.000136)	(.000659)	(.00031)	(.00010)
Export Dummy	-0.585***	-0.585***	-0.0538***	-0.0538***	0.367***	0.367***	0.304***	0.304***	-0.0260***	-0.0260*	-.0168**	-.0168**
	(0.00363)	(0.0275)	(.000643)	(.00632)	(0.0184)	(0.00420)	(0.0333)	(.00474)	(0.00327)	(0.0156)	(.0082)	(.0057)
Ownership	0.00391	0.00391	.00903***	.00903**	0.188***	0.188***	0.237***	0.237***	-0.214***	-0.214***	-.0364***	-.0364***
	(.00586)	(.0464)	(.00091)	(.00382)	(0.0220)	(0.00605)	(0.0301)	(.00664)	(0.00495)	(0.0271)	(.01196)	(.00902)
Constant	0.240***	0.240***	-0.0452***	-0.0452***	-1.903***	-3.411***	-2.120***	-1.903***	-1.903***	-1.903***	.2147***	.2147***
	(0.0117)	(0.0258)	(0.00216)	(0.0107)	(0.0290)	(0.0344)	(0.199)	(0.0168)	(0.0119)	(0.0176)	(.02759)	(.00629)
Sigma			0.232***	0.232***			1.108***	1.108***	-0.829***	-0.829***		
			(0.000198)	(0.0306)			(0.106)	(0.00244)	(0.0118)	(0.0162)		
Observations	902,175	902,175	902,175	902,175	902,175	902,175	902,175	902,175	902,175	902,175	902,175	902,175
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	No	Industry	No	Industry	No	Industry	No	Industry	No	Industry	No	Industry

Notes: Tax dummy equal to 1 if a firm pays tax, otherwise 0. Subsidy dummy equals to 1 if a firm receives subsidy, otherwise 0. Applied interest rate is measured with firm's interest payment divided by total liability. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** p<0.01, ** p<0.05, * p<0.1.

Table A.1.8: Effects of the Five Year Plan on Tax Payments

	Bottom tier		Middle tier		Top tier	
	Probit	Tobit	Probit	Tobit	Probit	Tobit
VARIABLES	Tax Dummy	Tax/Value-added	Tax Dummy	Tax/Value-added	Tax Dummy	Tax/Value-added
	(1)	(2)	(3)	(4)	(5)	(6)
Post2000	0.0989***	0.00186	0.0876***	-.00562***	0.0850***	-.0069***
	(0.0194)	(0.00589)	(0.0207)	(0.00158)	(0.0196)	(0.00127)
Supported	-0.168*	-0.0484***	-0.195**	-0.0219***	-0.202***	-0.0188***
	(0.0861)	(0.0177)	(0.0808)	(0.00752)	(0.0683)	(0.00572)
Post2000 × Supported	0.0871**	0.0226***	0.0733**	0.00885***	0.0448	0.00740***
	(0.0384)	(0.00859)	(0.0356)	(0.00334)	(0.0323)	(0.00253)
Age	0.0162***	0.00201***	0.0145***	0.000402**	0.00811***	0.000272
	(0.00150)	(0.000363)	(0.00175)	(0.000203)	(0.00154)	(0.000177)
Export Dummy	-0.724***	-0.150***	-0.587***	-0.0322***	-0.476***	-0.0201***
	(0.0491)	(0.0199)	(0.0505)	(0.00497)	(0.0442)	(0.00284)
Ownership	0.0186	0.0249***	-0.0185	0.00554	-0.127*	0.00457
	(0.0534)	(0.00834)	(0.0667)	(0.00582)	(0.0663)	(0.00745)
Constant	0.598***	-0.0377**	0.858***	0.0295***	0.981***	0.0310***
	(0.0379)	(0.0188)	(0.0390)	(0.00367)	(0.0286)	(0.00290)
Sigma		0.435***		0.108***		0.0891***
		(0.0630)		(0.0151)		(0.00835)
Observations	252,202	252,202	281,785	281,785	368,188	368,188
Cluster	Industry	Industry	Industry	Industry	Industry	Industry

Notes: Tax dummy equal to 1 if a firm pays tax, otherwise 0. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** p<0.01, ** p<0.05, * p<0.1.

Table A.1.9: Effects of the Five Year Plan on Subsidies

	Bottom tier		Middle tier		Top tier	
	Probit	Tobit	Probit	Tobit	Probit	Tobit
VARIABLES	Subsidy Dummy	Subsidy/Value-added	Subsidy Dummy	Subsidy/Value-added	Subsidy Dummy	Subsidy/Value-added
	(1)	(2)	(3)	(4)	(5)	(6)
Post2000	0.199***	0.286***	0.218***	0.126***	0.233***	0.0610***
	(0.0187)	(0.0417)	(0.0172)	(0.0370)	(0.0191)	(0.00715)
Supported	0.0297	0.0366	0.0513	0.0270	0.0646	0.0195
	(0.0477)	(0.0726)	(0.0488)	(0.0312)	(0.0426)	(0.0120)
Post2000 × Supported	0.0725	0.116	0.0462	0.0350	-0.00991	-0.00433
	(0.0461)	(0.0722)	(0.0411)	(0.0279)	(0.0305)	(0.00964)
Age	0.00660***	0.0106***	0.00616***	0.00375***	0.00599***	0.00161***
	(0.000639)	(0.00121)	(0.000891)	(0.00109)	(0.000896)	(0.000283)
Export Dummy	0.222***	0.259***	0.286***	0.133***	0.301***	0.0549***
	(0.0399)	(0.0718)	(0.0369)	(0.0507)	(0.0336)	(0.0120)
Ownership	0.170***	0.367***	0.169***	0.121***	0.225***	0.0693***
	(0.0321)	(0.0606)	(0.0342)	(0.0362)	(0.0389)	(0.0100)
Constant	-1.423***	-2.668***	-1.473***	-1.073***	-1.682***	-0.479***
	(0.0249)	(0.276)	(0.0226)	(0.309)	(0.0268)	(0.0453)
Sigma		1.790***		0.704***		0.283***
		(0.177)		(0.197)		(0.0260)
Observations	252,202	252,202	281,785	281,785	368,188	368,188
Cluster	Industry	Industry	Industry	Industry	Industry	Industry

Notes: Subsidy dummy equals to 1 if a firm receives subsidy, otherwise 0. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** p<0.01, ** p<0.05, * p<0.1.

Table A.1.10: Effects of the Five Year Plan on Interest Payments

Variables	Bottom tier		Middle tier		Top tier	
	Ordered Probit	OLS	Ordered Probit	OLS	Ordered Probit	OLS
	Interest Payments	Interests/Debt	Interest Payments	Interests/Debt	Interest Payments	Interests/Debt
	(1)	(2)	(3)	(4)	(5)	(6)
Post2000	-0.174***	-0.00778*	-0.193***	-0.0105***	-0.238***	-0.00473
	(0.0154)	(0.00455)	(0.0150)	(0.00377)	(0.0160)	(0.00647)
Supported	0.129*	0.000225	0.134*	-0.000938	0.114**	9.53e-05
	(0.0720)	(0.00467)	(0.0686)	(0.00471)	(0.0554)	(0.00535)
Post2000 ×	-0.0115	0.000147	-0.0189	0.0104	-0.0505	0.0234
Supported	(0.0272)	(0.00461)	(0.0252)	(0.0136)	(0.0341)	(0.0223)
Age	0.0119***	-4.28e-05	0.0108***	-0.000519***	0.0128***	0.000129
	(0.000635)	(5.69e-05)	(0.000742)	(0.000126)	(0.000839)	(0.000319)
Export Dummy	-0.200***	-0.0132***	-0.102***	-0.0198***	-0.116***	-0.0247
	(0.0373)	(0.00255)	(0.0322)	(0.00650)	(0.0255)	(0.0175)
Ownership	-0.157***	-0.0116***	-0.185***	-0.0188***	-0.297***	-0.0496***
	(0.0365)	(0.00221)	(0.0437)	(0.00308)	(0.0438)	(0.0120)
Cut point 1	-1.449***		-1.508***		-1.639***	
	(0.0257)		(0.0271)		(0.0244)	
Cut point 2	-0.507***		-0.547***		-0.457***	
	(0.0256)		(0.0242)		(0.0220)	
Constant		0.0378***		0.0601***		0.0710***
		(0.00597)		(0.00684)		(0.00504)
Observations	252,202	252,202	281,785	281,785	368,188	368,188
Cluster	Industry	Industry	Industry	Industry	Industry	Industry

Notes: Applied interest rate is measured with firm's interest payment divided by total liability. Applied interest rate D is a dummy variable with 1, 2, and 3, corresponding to whether a firm pays negative, zero and positive interest rate. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** p<0.01, ** p<0.05, * p<0.1.

Table A.1.11: Effects of the Five Year Plan on Tax Payments

	TFPR bottom tier				TFPR middle tier				TFPR top tier			
	Probit		Tobit		Probit		Tobit		Probit		Tobit	
VARIABLES	Tax Dummy		Tax/Value-added		Tax Dummy		Tax/Value-added		Tax Dummy		Tax/Value-added	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post2000×Supported	0.0683***	0.0683**	0.0107***	0.0107*	0.0676***	0.0676**	.00350***	.00350**	0.0385***	0.0385	.00425***	.00425***
	(0.0119)	(0.0275)	(0.00393)	(0.00575)	(0.0121)	(0.0292)	(0.000850)	(0.00166)	(0.0115)	(0.0256)	(0.000666)	(0.00149)
Age	0.0144***	0.0144***	.00163***	.00163***	0.0118***	.0118***	.00015***	.00015**	.00591***	.00591***	2.61e-05*	2.61e-05
	(0.000273)	(0.00109)	(7.70e-05)	(0.000291)	(0.000292)	(0.0014)	(1.75e-05)	(6.98e-05)	(0.000277)	(0.00122)	(1.47e-05)	(6.50e-05)
Export Dummy	-0.684***	-0.684***	-0.137***	-0.137***	-0.569***	-.569***	-0.0269***	-0.0269***	-0.454***	-0.454***	-0.0163***	-0.0163***
	(0.00653)	(0.0277)	(0.00229)	(0.0182)	(0.00663)	(0.0289)	(0.000489)	(0.00255)	(0.00602)	(0.0248)	(0.000365)	(0.00124)
Ownership	0.0747***	0.0747**	0.0263***	0.0263***	0.0486***	0.0486	0.00104	0.00104	-0.0792***	-0.0792	-.00286***	-0.00286
	(0.00953)	(0.0341)	(0.00285)	(0.00564)	(0.0109)	(0.0539)	(0.000689)	(0.00237)	(0.0106)	(0.0562)	(0.000587)	(0.00225)
Constant	-0.107***	-0.107***	-0.168***	-0.168***	0.229***	0.229***	0.00145	0.00145	0.478***	0.478***	.0119***	.0119***
	(0.0222)	(0.0273)	(0.00803)	(0.0303)	(.0207)	(.0360)	(.00161)	(.00488)	(.0191)	(.0237)	(.00119)	(.00256)
Sigma			0.431***	0.431***			.0995***	.0995***			0.0828***	0.0828***
			(0.00073)	(0.0634)			(.000152)	(.0133)			(.000109)	(.00653)
Observations	252,202	252,202	252,202	252,202	281,785	281,785	281,785	281,785	368,188	368,188	368,188	368,188
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Tax dummy equal to 1 if a firm pays tax, otherwise 0. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** p<0.01, ** p<0.05, * p<0.1.

Table A.1.12: Effects of the Five Year Plan on Subsidies

	TFPR bottom tier				TFPR middle tier				TFPR top tier			
	Probit		Tobit		Probit		Tobit		Probit		Tobit	
VARIABLES	Subsidy Dummy		Subsidy/Value-added		Subsidy Dummy		Subsidy/Value-added		Subsidy Dummy		Subsidy/Value-added	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post2000×Supported	0.0877***	0.0877**	0.135***	0.135**	0.0795***	0.0795*	0.0536***	0.0536*	0.0291**	0.0291	0.00777*	0.00777
	(0.0137)	(0.0439)	(0.0243)	(0.0666)	(0.0135)	(0.0437)	(0.00945)	(0.0294)	(0.0145)	(0.0383)	(0.00401)	(0.0119)
Age	.00674***	.00674***	0.0108***	0.0108***	0.00575***	.00575***	.00336***	.00336***	.00553***	.00553***	.00144***	.00144***
	(0.000260)	(0.000467)	(0.000458)	(0.00115)	(0.000265)	(0.000580)	(0.000184)	(0.000922)	(0.000291)	(0.000548)	(8.01e-05)	(0.000193)
Export Dummy	0.316***	0.316***	0.392***	0.392***	0.367***	0.367***	0.183***	0.183***	0.363***	0.363***	0.0737***	0.0737***
	(0.00756)	(0.0228)	(0.0136)	(0.0504)	(0.00731)	(0.0186)	(0.00516)	(0.0553)	(0.00718)	(0.0194)	(0.00203)	(0.00869)
Ownership	0.165***	0.165***	0.346***	0.346***	0.147***	0.147***	0.102***	0.102***	0.173***	0.173***	0.0551***	0.0551***
	(0.00983)	(0.0215)	(0.0173)	(0.0462)	(0.0106)	(0.0236)	(0.00732)	(0.0285)	(0.0117)	(0.0267)	(0.00318)	(0.00829)
Constant	-1.678***	-1.678***	-3.043***	-3.043***	-1.926***	-1.926***	-1.336***	-1.336***	-2.058***	-2.058***	-0.564***	-0.564***
	(0.0286)	(0.0311)	(0.0522)	(0.304)	(0.0295)	(0.0348)	(0.0213)	(0.379)	(0.0300)	(0.0269)	(0.00855)	(0.0542)
Sigma			1.780***	1.780***			0.697***	0.697***			0.279***	0.279***
			(0.00687)	(0.177)			(0.0026)	(0.197)			(0.00115)	(0.0258)
Observations	252,202	252,202	252,202	252,202	281,785	281,785	281,785	281,785	368,188	368,188	368,188	368,188
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

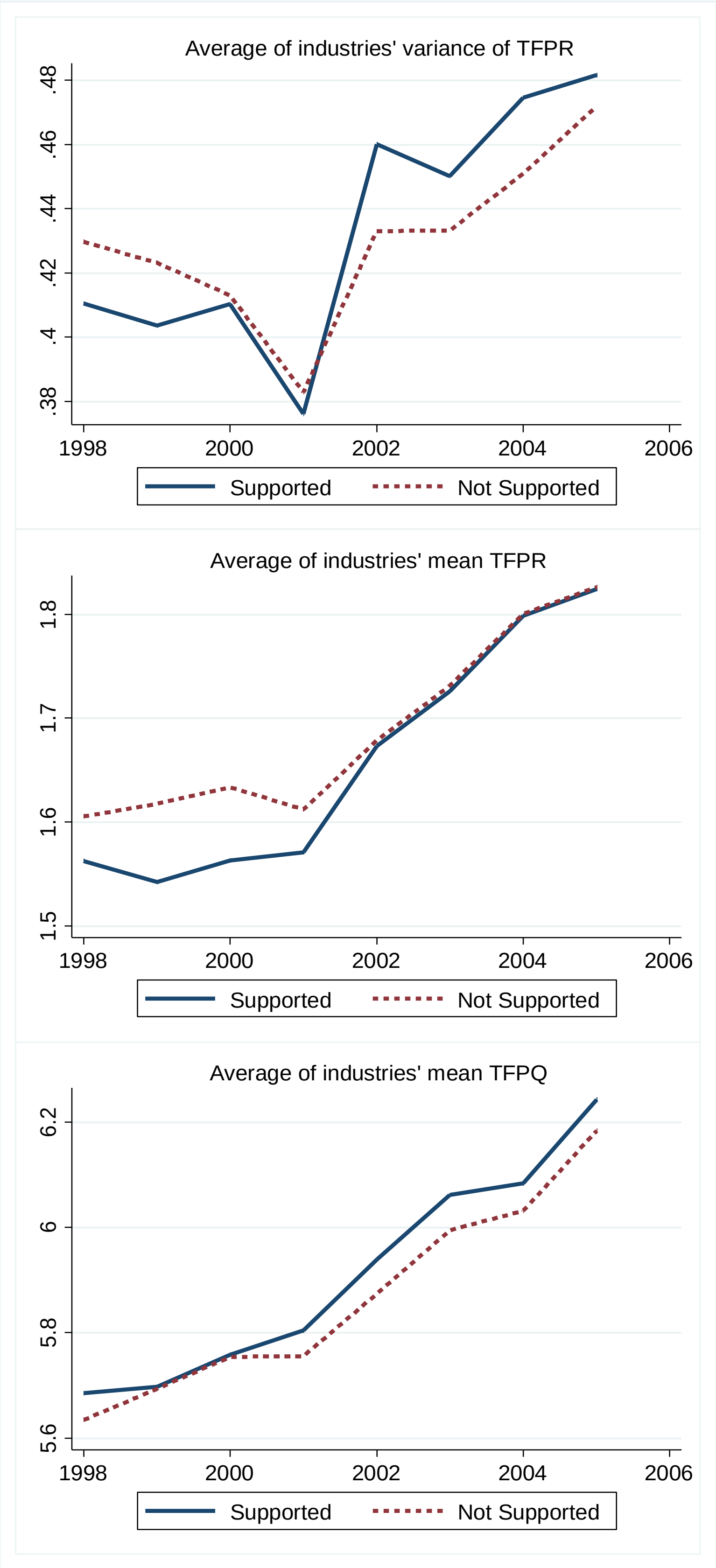
Notes: Subsidy dummy equals to 1 if a firm receives subsidy, otherwise 0. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** p<0.01, ** p<0.05, * p<0.1.

Table A.1.13: Effects of the Five Year Plan on Interest Payments

	TFPR bottom tier				TFPR middle tier				TFPR top tier			
	Ordered Probit		OLS		Ordered Probit		OLS		Ordered Probit		OLS	
VARIABLES	Applied interest rate D		Applied interest rate		Applied interest rate D		Applied interest rate		Applied interest rate D		Applied interest rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post2000×Supported	-0.00605	-0.00605	-0.000799	-0.000799	0.00636	0.00636	0.0154	0.0154	-0.0238**	-0.0238	0.0286	0.0286
	(0.0110)	(0.0229)	(0.00427)	(0.00372)	(0.0108)	(0.0238)	(0.0172)	(0.0183)	(0.0100)	(0.0239)	(0.0353)	(0.0250)
Age	0.0111***	0.0111***	-1.87e-05	-1.87e-05	0.00969***	.00969***	-0.000589	-0.000589***	0.0113***	0.0113***	4.96e-05	4.96e-05
	(0.000241)	(0.000589)	(8.71e-05)	(5.48e-05)	(0.000241)	(0.000739)	(0.000361)	(0.000225)	(0.000231)	(0.000794)	(0.000788)	(0.000272)
Export Dummy	-.0985***	-.0985***	-.0116***	-.0116***	-0.00298	-0.00298	-0.0174*	-0.0174***	0.00545	0.00545	-0.0147	-0.0147
	(0.00611)	(0.0233)	(0.00244)	(0.00241)	(0.00595)	(0.0174)	(0.00978)	(0.00512)	(0.00519)	(0.0120)	(0.0192)	(0.0144)
Ownership	-0.176***	-0.176***	-.0138***	-.0138***	-0.195***	-0.195***	-0.0259*	-0.0259***	-0.299***	-0.299***	-0.0609*	-.0609***
	(0.00842)	(0.0248)	(0.00321)	(0.00328)	(0.00895)	(0.0297)	(0.0141)	(0.00687)	(0.00868)	(0.0312)	(0.0313)	(0.0206)
Cut-point 1	-1.691***	-1.691***			-1.883***	-1.883***			-2.076***	-2.076***		
	(0.0230)	(0.0218)			(0.0213)	(0.0225)			(0.0187)	(0.0214)		
Cut-point 2	-0.721***	-0.721***			-0.894***	-0.894***			-0.858***	-0.858***		
	(0.0228)	(0.0207)			(0.0211)	(0.0190)			(0.0185)	(0.0157)		
Constant			0.0608***	0.0608***			0.108***	0.108***			0.393***	0.392***
			(0.0086)	(0.00142)			(0.0321)	(0.00812)			(0.0631)	(0.0155)
Observations	252,202	252,202	252,202	252,202	281,785	281,785	281,785	281,785	368,188	368,188	368,188	368,188
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Applied interest rate is measured with firm's interest payment divided by total liability. Applied interest rate D is a dummy variable with 1, 2, and 3, corresponding to whether a firm pays negative, zero and positive interest rate. Export dummy equal to 1 if a firm has exports. Ownership is measured with a dummy variable, which equals to 1 if a firm is state-owned, otherwise 0. *** p<0.01, ** p<0.05, * p<0.1

Figure A.1.1. Un-normalized Mean and Variance of TFPR and TFPQ



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Vita

Guowen Chen

Education

Master of Science in Economics, University of Kentucky	2015
Master of Science in Finance, Tongji University	2013
BA in Business English, Xiamen University of Technology	2010

Teaching Experience

Recitation Instructor

ECO 702: Advanced Macroeconomic Theory (Graduate level)	Spring 2019
ECO 590: Introduction to Quantitative Economics (Graduate level)	Fall 2016
ECO 703: Introduction to Econometrics I. (Graduate level)	Spring 2016
ECO 601: Advanced Microeconomic Theory (Graduate level)	Fall 2015

Primary Instructor

ECO 402: Intermediate Macroeconomic Theory (1 section)	Summer 2019
ECO 202: Principles of Macroeconomics (1 section)	Fall 2018
ECO 201: Principles of Microeconomics (1 section)	Summer 2018
ECO 391: Economic and Business Statistics (2 sections)	Spring 2018
ECO 391: Economic and Business Statistics (2 sections)	Spring 2017
ECO 202: Principles of Macroeconomics, (2 sections) (Online)	Fall 2016

Honors and Awards

Teaching Assistantship, University of Kentucky	2015-2018
Gatton Doctoral Fellowship, University of Kentucky	2014-2018
Institute for the Study of Free Enterprise Fellowship	Summer 2017

Professional and Invited Presentations

Kentucky Economic Association Conference, Bowling Green, KY, October, 2017.
Chinese Economic Society Conference, Athens, GA, April, 2018.
Chinese Economic Society Conference, Hefei, China, June, 2018.