Policy and Misallocation*

Guowen Chen
University of Kentucky

Ana María Herrera
University of Kentucky

Steven Lugauer
University of Kentucky

October 18, 2018

Abstract

This paper investigates the effect of industrial policies on resource misallocation using a rich data-set of Chinese firms. Using a difference-in-difference approach, we provide evidence that government policies favoring particular industries lead to increased resource misallocation (i.e., an increase in the dispersion of revenue productivity across firms in four-digit industries). Moreover, the differential changes between supported and not supported industries are quantitatively large and indicative of a substantial negative impact on aggregate TFP. Using a changes-in-changes model, we 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. Our results suggest increased misallocation is related to the way in which the Chinese government doled support through the increase of subsidies and the improvement of credit conditions for a subset of firms

Keywords: Misallocation; Total Factor Productivity; China

JEL Codes: D24, L25, O47

*We are grateful to graduate macro reading group in University of Kentucky for useful comments and discussions. We thank discusscants and participants at the CES and KEA conference.

1 Introduction

A large and growing literature has argued that resource 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 resource 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 a large sample of Chinese firms from 1998 to 2005, to estimate the misallocation due to the centralized planning in 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 resource misallocation between supported and not supported industries.

Our work is closely related to that of Hsieh and Klenow (2009) who use the same data

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

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 countrywide misallocation documented by Hsieh and Klenow may result from a particular policy intervention.

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 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 resource misallocation, especially for the supported industries. This finding is our main result, and it is robust to including a host of industry-level control variables, such as the average firm age, the share of state owned firms, and the average share of export revenue to value-added.

We also find that the average profitability (TFPR) and physical productivity (TFPQ) of firms in supported industries increases relative to firms in not supported industries. Thus, we examine whether the plan had a heterogeneous effect on the supported firms by using a changes-in-changes (CIC) model to estimate the quantile treatment effects on the supported firms. The CIC strategy enables us to investigate how the Five Year Plan affected the whole distribution of TFPR and TFPQ. Our estimation results indicate that the Five Year Plan had a positive and significant effect on most of the TFPR distribution. As for the distribution of TFPQ, the effect is negative and significant for the lower quintile, positive and significant for the highest quintile and insignificant for the middle quintiles of the physical productivity (TFPQ) distribution. In short, while the implemented industrial policies caused the most productive firms to became more profitable, firms in the extreme left tail of the distribution languished.

The rather homogenous effect on the distribution of TFPR and heterogeneous effect on TFPQ thus poses the question: what mechanisms are used by the Chinese government to promote the supported industries? We tackle this question by inquiring whether the 10th Five Year Plan impacted the probability that firms in the supported industries would pay taxes, receive subsidies or pay/receive interests. We also examined 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. Our estimation results suggest the Chinese government support was doled out to industries via direct subsidies and improved credit conditions. Moreover, differences in the probability of receiving these supports as well as in the magnitude of the support across firms in the top and bottom tiers of the TFPR distribution hint to two mechanisms that increased the wedge between the observed and the efficient level of TFPR and decreased aggregate TFP: subsidies and credit conditions.

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 (2014) 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. (2007) also find the effects of policies on productivity vary due to different firm characteristics. Bartelsman et al. (2009) 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 details how we use the firm-level data to measure resource misallocation and offers a brief overview of China's Five Year Plans. Section 3 discusses the empirical strategy, presents our main empirical results as well as several robustness checks. Section 4 investigates the effect of the Five Year Plan on average TFPR and TFPQ, tests whether the effects where heterogeneous across the TFPR and TFPQ distributions, and inquiries into the mechanisms used to dole out support. Section 5 concludes

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 resource misallocation by industry.

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 firms in 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 are 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 large firms with 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) resource misallocation is an empirical question.

2.2 Measuring Resource 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.[2]

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

[2] 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.

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 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

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

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:

$$TFPQ_{si} = A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s} \left(wL_{si}\right)^{1-\alpha_s}}. \tag{2}$$

We take Equation (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.

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

$$\log TFP_s = \frac{1}{1-\sigma} \log \left(\sum_{i=1}^{M_s} A_{si}^{\sigma-1} \right) - \frac{\sigma}{2} var \left(\log TFPR_s \right) \tag{3}$$

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.[3] Note, the variance of TFPR is a sufficient statistic to measure the decrease in TFP due to the dispersion

[3] 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.

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 resource misallocation. Moreover, although there are many mechanisms by which misallocation could manifest itself,[4] an increase in misallocation will result in larger dispersion in TFPR.

2.3 Data■

To calculate the degree of resource 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 all state-owned and non-state-owned firms with nominal revenues exceeding 5 million yuan (around $800,000). The non-state-owned firms contain private, foreign and hybrid (local collectives, local government owned, etc.) firms. 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 from Equation (1) using data on value-added, wage payments, and capital stock. Because data on prices, P_{si}, and non-wage compensation are not available from the survey, we follow Hsieh and Klenow's (2009) computation. 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 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.[5] 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 resource misallocation.

[4] See Hopehayn and Rogerson (1993), Lagos (2006), Caselli and Gennaioli (2003), Buera and Shin (2008), and Guner, Ventura, and Xu (2008) for examples.

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

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_{it}, 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 $\sigma/(\sigma-1)$ to obtain an estimate of Y_{it}. Replacing this estimate in Equation (2) we obtain

$$TFPQ_{si} = A_{si} = \frac{(P_{si}Y_{si})^{\frac{\sigma}{\sigma-1}}}{K_{si}^{\alpha_s}(wL_{si})^{1-\alpha_s}}, \tag{4}$$

where σ is the elasticity of substitution. 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 resource 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 "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 resource misallocation.

3 The Effect of Industrial Policy on Resource Misallocation

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

3.1 Descriptive Evidence of the Impact of the 10th Five Year Plan on Resource Misallocation

The evolution of the variance of the logarithm of TFPR ($var\left(\log TFPR\right)$) provides preliminary evidence that indicates the industrial policy lead to an increase in resource misallocation. Figure 1 plots the average $var\left(\log TFPR\right)$ 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 1. Both groups had similar trends in resource misallocation prior to the enactment of the 10th 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 10th Five Year Plan, misallocation increased by only 10 percent relative to 1998. This pattern suggests that the 10th Five Year Plan had a differential, and very large, impact on misallocation within supported industries. Since the average $var\left(\log TFPR\right)$ increased for both groups, it is also consistent with the notion that the 10th Five Year Plan increased misallocation, overall.

FIGURE 1 HERE

The Chinese government might have decided to support particular industries because it prioritized industries where resource misallocation was greater. After all, one of the objectives of the 10th Five Year Plan was to adjust development patterns across different industries. Table 1 reports the average of the variance of the log of TFPR, the mean TFPR and mean TFPQ broken down by supported and not supported industries in the year prior to the 10th Five Year Plan. The supported industries, on average, exhibited similar resource misallocation (dispersion of TFPR) as the not supported industries. However, the firms supported by the 10th Five Year Plan were, on average, younger, more export oriented and had a smaller government ownership. This might explain the initially lower degree of resource misallocation in supported firms.

TABLE 1 HERE

3.2 Estimation Strategy

Our difference-in-difference (DID) regression approach allows us to adjust the raw comparison in Figure 1 by other covariates that could affect resource 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:

$$var\left(\log TFPR_{st}\right) = \alpha + \delta Post2000_t + \eta Supported_s + \beta\left(Post2000 \times Supported\right)_{st} + X_{st}\gamma + \varepsilon_{st} \tag{5}$$

where $var\left(\log TFPR_s\right)_t$ is the variance of log TFPR for 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.[6] 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 1991; 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

[6] The Appendix reports results without the control variables and adding the controls one at a time. The results are basically the same as the main specification below.

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, exports/VA. The exports/VA ratio is also intended to control for the increased participation of China in world trade.[7] 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 $var\left(\log TFPR_{st}\right)$, our measure of resource misallocation, in the supported industries, before and after the plan was put in place, with $var\left(\log TFPR_{st}\right)$ of the not supported group over the same period. In this 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.

3.3 Estimation Results

Table 2 reports the estimation results for Equation (5). Columns 1 and 2 report OLS estimates, with and without the control variables. Columns 3 and 4 report WLS estimates, also with and without 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.

TABLE 2 HERE

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

The estimate of β (on $Post2000 \times Supported$) 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 10th 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 years time horizon included in our analysis.

Moreover, the impact on misallocation is quantitatively large. Consider the most conservative result; in column 2, the estimate of β equals 0.026. One way to interpret this number is to look back at Table 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. Another way to interpret β is to look back at Equation (3). The increase in the variance of TFPR reduces overall TFP. 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 3 and 4 of Table 2, the WLS estimates for β are larger (0.065 and 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 quite big because the larger industries, quite obviously, make up a large share of the economy. If the 10th 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 1, and is reflected in the positive and significant estimate of ϕ (see Table 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 2 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 sectors with a higher share of export revenues to value added have less resource misallocation. Finally, industries with more

State-Owned Enterprises exhibit much greater misallocation.

3.4 Robustness Checks

If resource 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 Table 1 suggest that the Chinese government did not target industries that had more resource misallocation. Note how the mean of $var\left(\log TFPR\right)$ 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 10th Five Year Plan do not touch on the question of resource misallocation. Instead, the general objective was to foster economic growth and improve international competitiveness. To further explore this issue, Table 3 reports estimates for the model in (5) augmented with leads of the industrial policy. More precisely, we add indicator variables for one, $2000 \times Supported$, and two, $1999 \times Supported$, 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 3 HERE

While the use of the variance of $log(TFPR)$ to measure resource 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 re-estimate Equation (5) using as dependent variables the interdecile and the interquartile range. The estimation results reported in Table 4 confirm our previous findings: industrial policies resulted in a significant increase in resource misallocation. Indeed, the effect appears to have been larger for firms further away in the tails of the distribution.

TABLE 4 HERE

4 Industrial Policy and Average Productivity

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 TFPR for supported firms but had little or no effect on TFPQ. Then, we inquire whether the effect of the policy was heterogeneous across firms with different levels of revenue (TFPR) or physical (TFPQ) productivity. Finally, we explore the possible mechanisms for how firms received support.

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 resource 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 (5) where we replace the variance of TFPR with the industry mean of log TFPR. Columns (1) and (2) in Table 5 report the results. Again, we focus on the estimated coefficient for the interaction term ($Post2000 \times Supported$). 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.

TABLE 5 HERE

Columns (3) and (4) in Table 5 report the results using mean log TFPQ as the dependent variable. In these regressions, the null of no average treatment effect ($\beta = 0$) cannot be rejected. We find no evidence that supported firms experienced an increase in the average physical productivity or technology level. Recall from Equations (1) and (2), TFPR equals TFPQ times price.[8] Thus, the support obtained through the 10th Five Year Plan appears to have primarily increased the price that supported industries charged, rather than their actual productivity.

[8] 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.

4.2 Heterogenous Effects of the 10th Five Year Plan

In Section 3.3 we described how the DID strategy uncovers significant effects of the 10th Five Year Plan on resource misallocation. In Section 4.1, We showed that the 10th Five Year Plan also leads to an increase in the mean of TFPR. Supported industries became more profitable on average but resource 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 recover the quantile treatment on the supported effect in the difference-in-difference setting and to check whether there exists evidence of heterogeneous effects.

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 10th Five Year Plan and compare it with the observed TFPR distribution. We first do this by estimating a CIC regression without including the covariates (see Figure 2, Panel A). Then we follow Garlick's (2018) methodology and redo the computation controlling for the same covariates as in Section 3.3 (see Figure 2, Panel B).

FIGURE 2 HERE

The horizontal distance between the observed and the counterfactual TFPR distribution at each quantile represents the quantile treatment effect of the 10th Five Year Plan on firms from the supported industries. This distance, without and with adjustment for covariates, is plotted in Figure 3 along with the 95% confidence intervals constructed using a percentile bootstrap clustering at the industry-year level. 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.

FIGURE 3 HERE

We also compute the counterfactual TFPQ distribution for the supported firms (Figure 4) and estimate the quantile treatment effect on TFPQ (Figure 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.

FIGURE 4 HERE

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 6 reports summary statistics for the observed and counterfactual TFPR and TFPQ distributions. On the one hand, the mean and variance of TFPR are somewhat higher for the observed (supported) than the counterfactual distribution, regardless of the adjustment. The support provided by the 10th Five Year Plan increased the mean of TFPR by about 2% and the variance by approximately 1%. 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, whereas the variance is approximately 6% higher. The support doled out by the 10th 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.

TABLE 6 HERE

4.3 Mechanism

An explanation for why the average support effect was positive and significant for TFPR but insignificant for TFPQ might be related to how the central government doled out support. 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 10th Five Year Plan does not contain information regarding the mechanism used to support firms. So, we turn to the data.

In 2000 –the year prior to the 10th Five-Year plan– 76.2% of the firms in the sample paid taxes, 11% received subsidies and 73% paid or received (6%) interest. To dig deeper into the possible mechanisms used to support firms, 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:

$$\Pr(Y_{ist} = 1) = \phi\left[\alpha + \delta Post2000_{ist} + \eta Supported_{ist} + \beta\left(Post2000 \times Supported\right)_{ist} + \varepsilon_{ist}\right] \tag{6}$$

where $Y_{ist} = 1$ if firm i in sector 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 to tackle this question.

TABLE 7 HERE

Columns (1) and (2) of Table 7 report the estimation results for the probability of paying taxes with and without clustering at the four-digit industry level, respectively. Columns (3) and (4) report the estimation results for the Tobit. Before we discuss our results, recall that while the coefficient on the interaction term in the probit/Tobit model does not equal the effect of the treatment (support), 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 $Post2000 \times Supported$ suggests that tax breaks were not used as a method to support firms during the 10th Five Year Plan. On the contrary, the plan increased the probability of paying taxes. Moreover, the support provided by the plan did increase the average tax to value added ratio for the supported firms.

Estimation results reported in columns (5) to (8) of Table 7 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. As one would expect, clustering by four-digit industry level increases the magnitude of the standard errors. Yet, the positive sign on the interaction terms is suggestive of a positive effect of the support on the probability of paying subsidies and the ratio of subsidies to value added.

Finally, we explore the impact of the plan on the credit conditions faced by the supported firms. Columns (9) -(10) report the estimation results for an ordered probit model where the dependent variable takes a value of zero if the firm receives 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 columns (11) and (12). Our estimates suggest the 10th Five Year Plan reduced the probability of paying interest for the supported firms, thus reflecting an improvement in credit conditions. However, the OLS results suggest there was no significant effect of the 10th Five Year Plan on the interest to debt ratio.

Given our finding of a heterogeneous effect of the Five Year Plan on TFPR and TFPQ, we further inquire into the workings of the support mechanism across firms. Recall that the

CIC model indicated that the plan increased TFPR for most of the distribution –with the increases being somewhat greater for the extreme tail of the distribution–, whereas the effect on TFPQ was negative for the lower quintile and positive for the upper quintile. To do so, we split the firms into tiers according to the observed TFPR over the years preceding the plan (1998-2000).

Tables 8 through 10 reproduce the estimation results when the sample is split in three subsamples. Three key insights are derived from these tables. First, the industrial policy implemented by the Chinese government increased the probability of paying taxes and the tax to value added ratio for all firms. Yet while the probability of being taxed increased more for the bottom than the top tier, the effect on the tax to value added ratio was greater for the latter (see Table 8). Second, the increase in the probability of receiving subsidies and in the ratio of subsidies to value added was concentrated in the middle and bottom tiers (see Table 9). That is, firms in the bottom or middle terciles of the TFPR distribution had higher chances of receiving subsidies from 10th Five Year Plan. Instead, the more productive firms do not appear to have benefited from the policy. Third, we find only some suggestive evidence indicating that firms in the top and middle TFPR terciles benefited from the plan more than firms in the bottom tercile (see Table 10). Note that the sign on the interaction term for the ordered probit model is positive but only marginally significant.

TABLES 8-10 HERE

5 Conclusions

This paper explored the effect of China's five-year industrial policies to the allocation of resources across industries. Using micro-level data on manufacturing firms and a difference-in-difference approach, we find that industrial policies had important effects on resource misallocation. In fact, the 10th Five Year Plan increased resource misallocation within the supported industries as evidenced by the increase in the variance of TFPR. We show that effect is robust to controlling for the average age of firms in an industry, the share of government owned firms, and the ratio of exports to value added.

Using a changes-in-changes model, we the estimated the effect of the treatment (the 10th

Five Year Plan) on the supported firms. Our results revealed a positive and significant effect for most of the TFPR distribution, with the effect being larger for firms with higher revenue productivity. Interestingly, the 10th Five Year plan had a heterogeneous effect on the physical productivity of the supported firms. Whereas TFPQ experienced a significant decline for firms in the lowest quintile, it increased for firm in the top quintile. Given that revenue productivity (TFPR) is computed as the product of the output price times the physical productivity (TFPQ), these results indicate that the treatment led to an increase in prices across all the distribution of supported firms.

Finally, our results suggested that direct government subsidies and better credit conditions constituted the channels whereby the Five Year plan contributed to increase resource misallocation. Firms in the supported industries where more likely to receive subsidies and less likely to incur interest payments. Furthermore, we found that supported firms in the low tier of the TFPR distribution received more subsidies than the non-supported firms whereas firms in the highest TFPR tier were less likely to pay interests if they received the support of the Five Year Plan.

References

[1] Aghion, Philippe, Robin Burgess, Stephen J. Redding, and Fabrizio Zilibotti. "The unequal effects of liberalization: Evidence from dismantling the License Raj in India." The American Economic Review 98.4 (2008): 1397-1412.

[2] Alfaro, Laura, Andrew Charlton, and Fabio Kanczuk. "Plant-size distribution and cross-country income differences." National Bureau of Economic Research. No. w14060 (2008).

[3] Athey, Susan, and Guido W. Imbens. "Identification and inference in nonlinear difference-in-differences models." Econometrica 74.2 (2006): 431-497.

[4] Bartelsman, Eric, John Haltiwanger, and Stefano Scarpetta. "Cross-country and within-country differences in the business climate." International Journal of Industrial Organization 28.4 (2010): 368-371.

[5] Broda, Christian, and David Weinstein. "Globalization and gains from variety." The quarterly journal of economics. Vol. 121 (2006):541-585.

[6] Buera, Francisco J., and Yongseok Shin. "Productivity growth and capital flows: The dynamics of reforms." No. w15268. National Bureau of Economic Research, 2009.

[7] Caselli, Francesco, and Nicola Gennaioli. "Dynastic management." Working paper (2003):971-996.

[8] Curtis, Chadwick C. "Economic reforms and the evolution of China's total factor productivity." Review of Economic Dynamics 21 (2016): 225-245.

[9] Dollar, David, and Shang-Jin Wei. "Das (wasted) kapital: firm ownership and investment efficiency in China." IMF working papers. Vol 07.9 (2007).

[10] Doms, Mark, Timothy Dunne, and Mark J. Roberts. "The role of technology use in the survival and growth of manufacturing plants." International journal of industrial organization 13, no. 4 (1995): 523-542.

[11] Foster, Lucia, John Haltiwanger, and Chad Syverson. "Reallocation, firm turnover, and efficiency: Selection on productivity or profitability?." The American economic review 98.1 (2008): 394-425.

[12] Garlick, Robert. "Academic peer effects with different group assignment policies: Residential tracking versus random assignment." *American Economic Journal: Applied Economics,* 10.3 (2018): 345-69.

[13] Guner, Nezih, Gustavo Ventura, and Xu Yi. "Macroeconomic Implications of Size-Dependent Policies." Review of Economic Dynamics, forthcoming. Vol 11.4 (2007).

[14] Hendel, Igal, and Aviv Nevo. "Measuring the implications of sales and consumer inventory behavior." Econometrica. Vol. 74 (2006): 1637-1673.

[15] Hsieh, Chang-Tai, and Peter J. Klenow. "Misallocation and manufacturing TFP in China and India." The Quarterly journal of economics 124.4 (2009): 1403-1448.

[16] Jensen, J. Bradford, Robert H. McGuckin, and Kevin J. Stiroh. "The impact of vintage and survival on productivity: Evidence from cohorts of US manufacturing plants." Review of Economics and Statistics 83, no. 2 (2001): 323-332.

[17] Lagos, Ricardo. "A model of TFP." The Review of Economic Studies 73.4 (2006): 983-1007.

[18] Melitz, Marc J. "The impact of trade on intra-industry reallocations and aggregate industry productivity." Econometrica 71.6 (2003): 1695-1725.

[19] Puhani, Patrick A. "The treatment effect, the cross difference, and the interaction term in nonlinear "difference-in-differences" models." Economics Letters 115.1 (2012): 85-87.

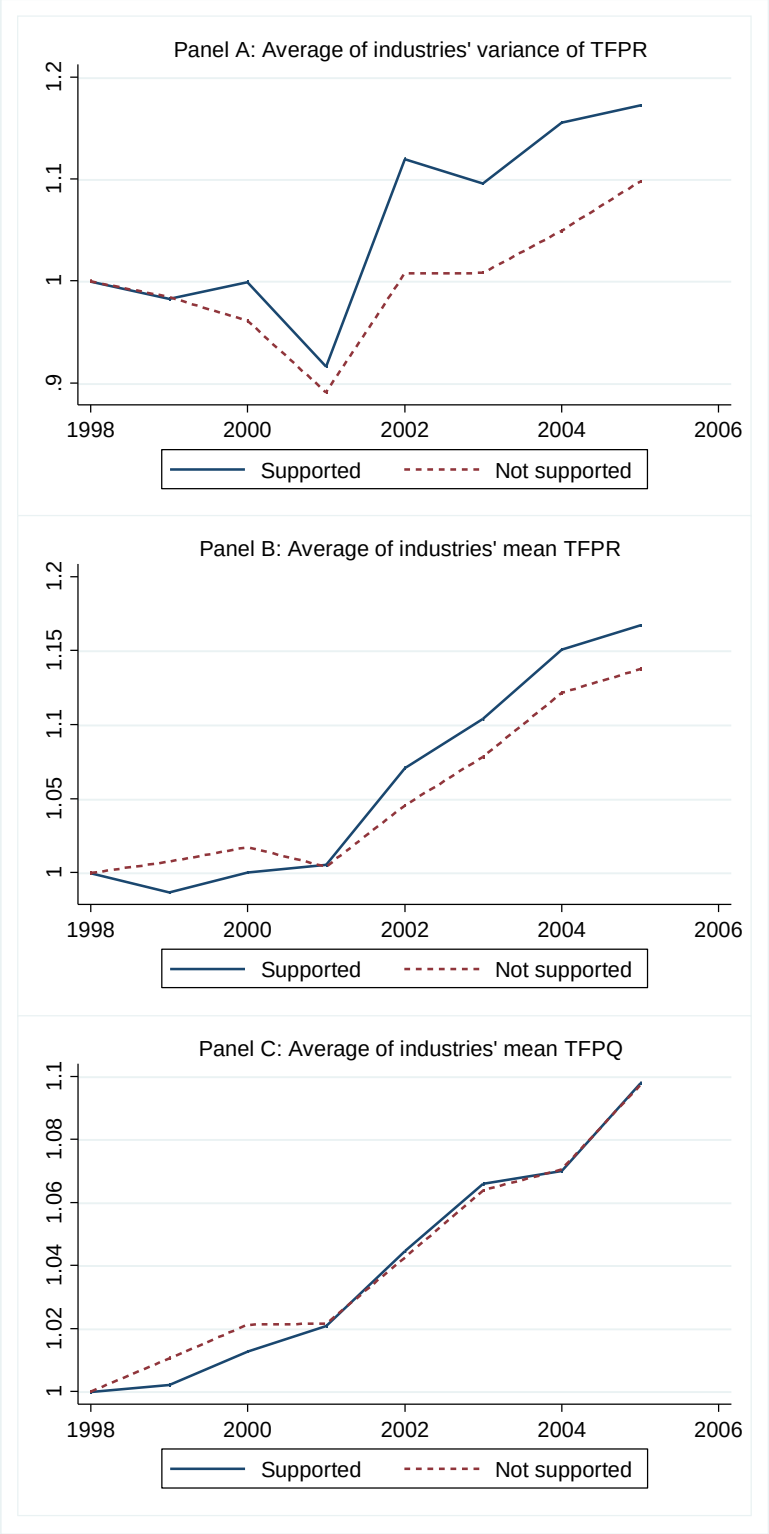
[20] Restuccia, Diego, and Richard Rogerson. "Policy distortions and aggregate productivity with heterogeneous establishments." 11.4 (2008): 707-720.

[21] Restuccia, Diego, and Richard Rogerson. "The Causes and Costs of Misallocation." Journal of Economic Perspectives 31.3 (2017): 151-174.

[22] Song, Zheng, and Guiying Laura Wu. "Identifying capital misallocation." Working Paper. http://faculty. chicagobooth. edu/zheng. song/research/SW_ web. pdf. 347, 2014.

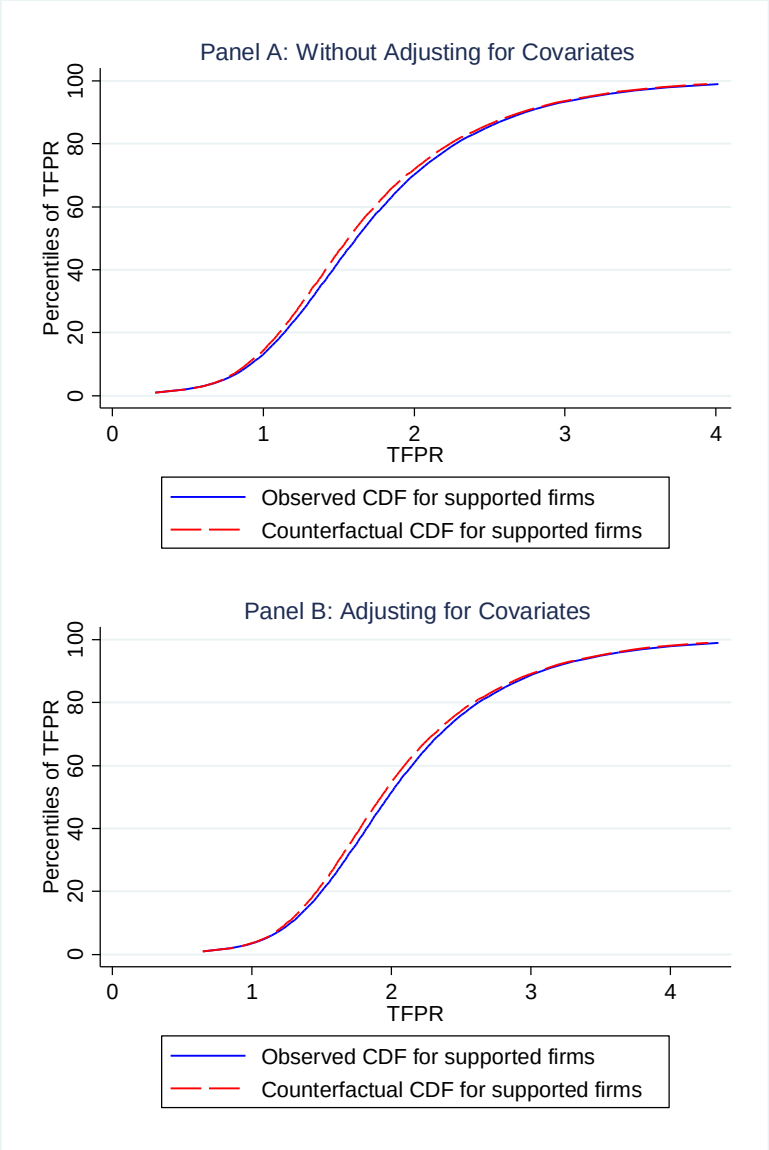
[23] Wagner, Joachim. "Exports and productivity: A survey of the evidence from firm-level data." World Economy 30, no. 1 (2007): 60-82.

Figure 1 Normalized mean or variance of TFPR and TFPQ



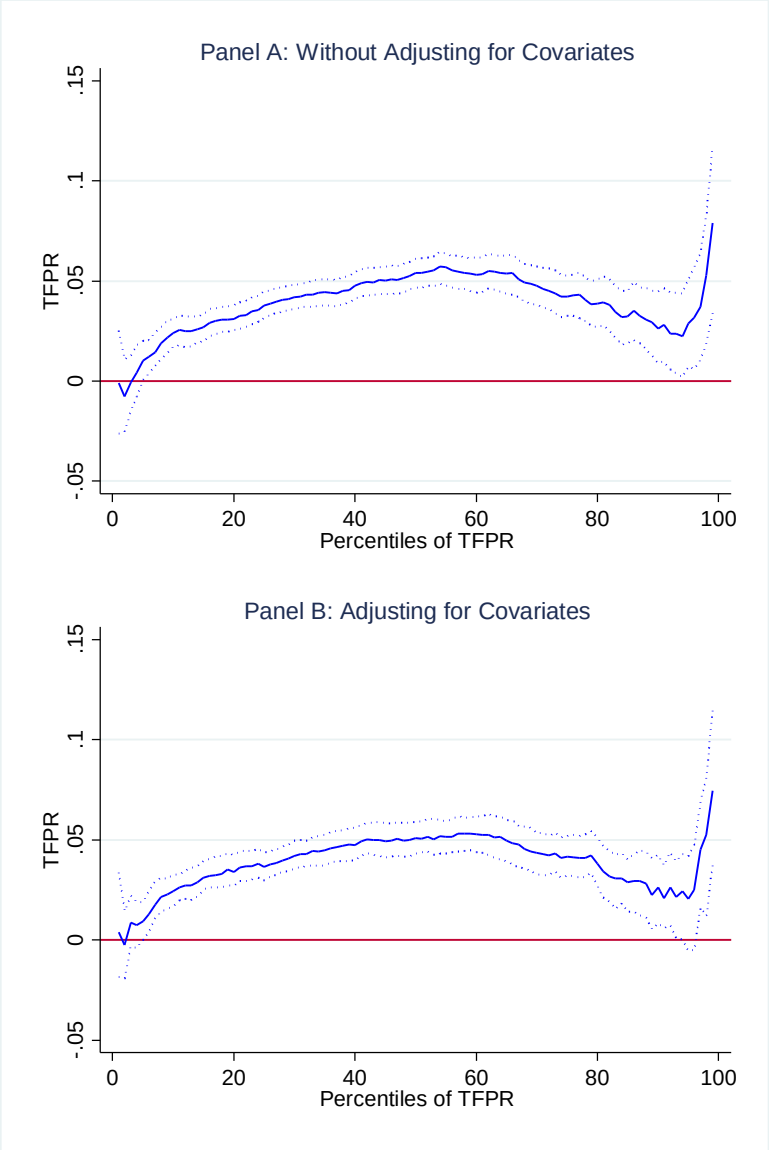
Notes: The values in 1998 for each variable is normalized to be1, and values in other years are divided by the original values in 1998 for each variable.

Figure 2 Quantile treatment effects of 10th Five-Year Plan on TFPR



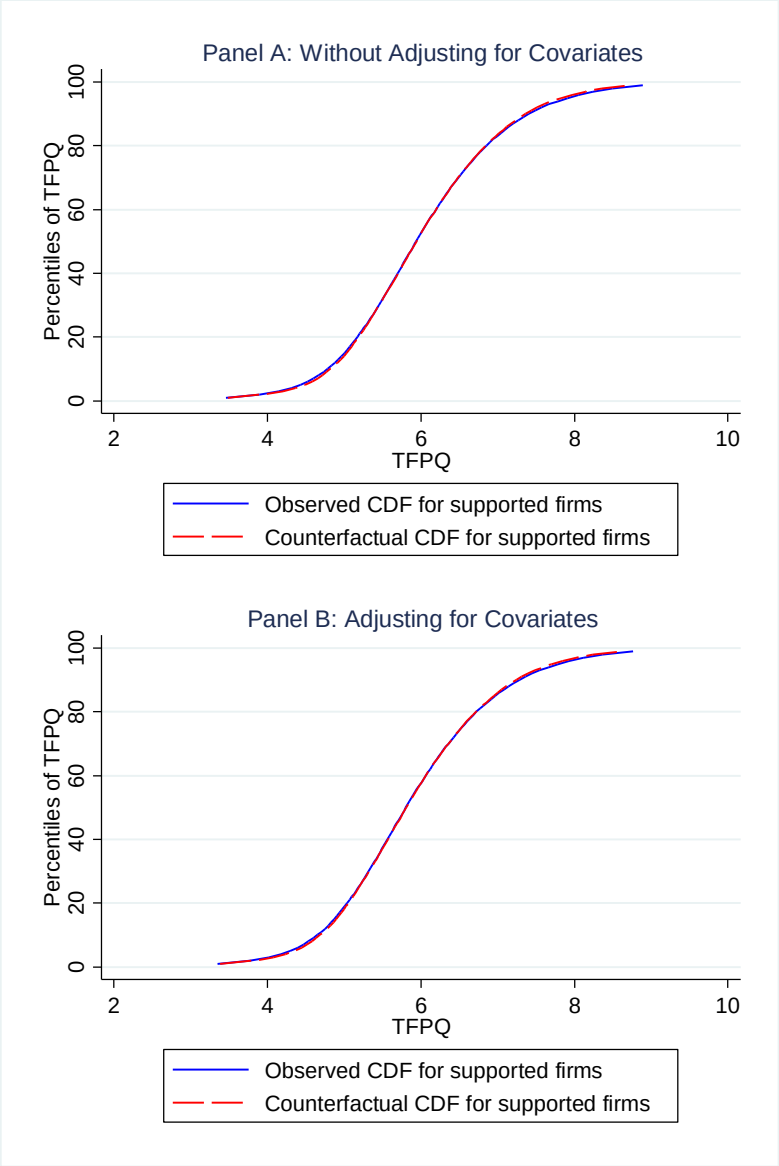
Notes: The covariates include firm's age, export dummy variable, and firm's ownership.

Figure 3 Quantile treatment effect on TFPR of the 10th Five-Year Plan on the supported firms



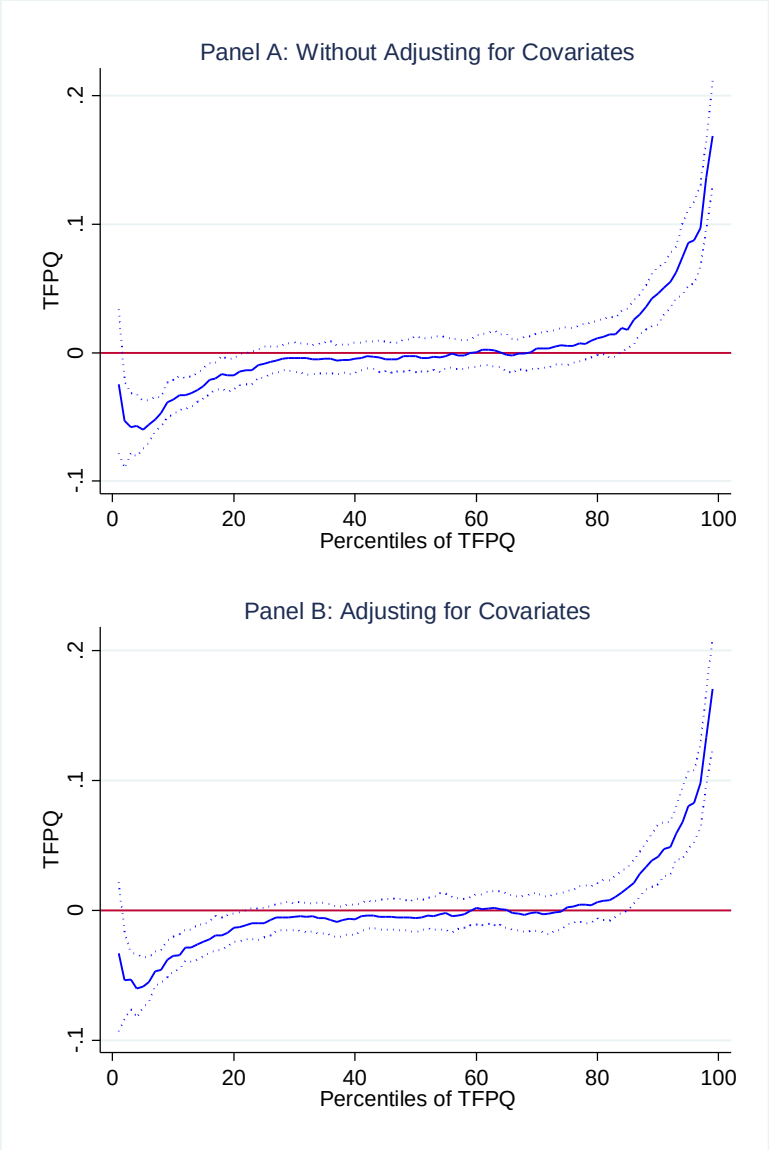
Notes: The control variables include firm's export share to value-added, age, and ownership. Solid lines denote the effects of the 10th Five-Year Plan on changes at percentiles of firms' TFPR, and dash lines refer to the confidence intervals at 5% level.

Figure 4. Quantile treatment effects of 10th Five-Year Plan on TFPQ



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

Figure 5 Quantile treatment effect on TFPR of the 10th Five-Year Plan on the supported firms



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% level.

Table 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
Applied interest rate	.0383	.0397
Tax/VA	.0320	.0486
Subsidy share	.1202	.1102
Subsidy/VA	.0210	.0212
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. Applied interest rate is the average ratio of interest payments to total debt across firms 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. The Effect of the 10th Five-Year Plan on the Variance of TFPR

	OLS		WLS	
Dependent Variable	V(TFPR)	V(TFPR)	V(TFPR)	V(TFPR)
	(1)	(2)	(4)	(5)
Post2000	0.0124*	0.0207*	0.000392	0.0241
	(0.00641)	(0.0121)	(0.0106)	(0.0151)
Supported	-0.0138	-0.0144	-0.0294	-0.0148
	(0.0255)	(0.0230)	(0.0457)	(0.0381)
Post2000 × Supported	0.0280**	0.0264*	0.0649***	0.0576***
	(0.0120)	(0.0139)	(0.0171)	(0.0210)
Mean(Age)		-0.0159***		-0.0142***
		(0.00266)		(0.00534)
Mean(Export/VA)		-0.0260***		-0.0385***
		(0.00696)		(0.0140)
Mean(SOE share)		0.467***		0.475**
		(0.101)		(0.188)
Constant	0.422***	0.572***	0.449***	0.571***
	(0.0144)	(0.0357)	(0.0228)	(0.0420)
R-squared	0.003	0.085	0.009	0.104

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 3. Anticipated Effect of the 10th Five-Year Plan on the Variance of TFPR

	OLS	WLS
	V(TFPR)	V(TFPR)
Dependent variable	(1)	(2)
1999 × Supported	0.000468	-0.0445
	(0.0158)	(0.0393)
2000 × Supported	0.0168	-0.000845
	(0.0163)	(0.0334)
Post2000 × Supported	0.0310*	0.0201
	(0.0160)	(0.0267)
Mean(Age)	-0.00380**	-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)
Constant	0.950***	0.996***
	(0.0328)	(0.0473)
R-squared	0.858	0.907

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. 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 4. The Effect of the 10th Five-Year Plan on the Dispersion of TFPR

Dependent Variable	OLS		WLS	
	90th -10th	75th -25th	90th -10th	75th -25th
	(1)	(2)	(3)	(4)
Post2000	0.0213	0.0117	0.0401	0.0225
	(0.0268)	(0.0144)	(0.0351)	(0.0186)
Supported	-0.0374	-0.0313	-0.0344	-0.0272
	(0.0534)	(0.0285)	(0.0859)	(0.0456)
Post2000 × Supported	0.0647**	0.0398**	0.132***	0.0815***
	(0.0314)	(0.0184)	(0.0442)	(0.0250)
Mean(Age)	-0.0357***	-0.0220***	-0.0318***	-0.0202***
	(0.00598)	(0.00313)	(0.0120)	(0.00641)
Mean(Export/VA)	-0.0625***	-0.0306***	-0.0887***	-0.0435***
	(0.0142)	(0.00748)	(0.0294)	(0.0153)
Mean(SOE share)	0.989***	0.529***	1.039**	0.585**
	(0.227)	(0.117)	(0.424)	(0.226)
Constant	1.936***	1.016***	1.914***	0.998***
	(0.0779)	(0.0403)	(0.0955)	(0.0504)
R-squared	0.086	0.094	0.106	0.105

Notes: 90th -10th and 75th -25th denote the difference in log(TFPR) values between the 90th and the 10th percentile and between the 75th and the 25th percentile, respectively. 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. 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 5. Effects of the 10th Five-Year Plan on Mean of TFPR and TFPQ

	OLS				WLS			
VARIABLES	M(TFPR)		M(TFPQ)		M(TFPR)		M(TFPQ)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post2000	0.111***	0.0914***	0.274***	0.264***	0.129***	0.249***	0.323***	0.660***
	(0.0105)	(0.0241)	(0.0136)	(0.0481)	(0.0215)	(0.0551)	(0.0595)	(0.118)
Supported	-0.0630	-0.0579	0.0200	0.0213	-0.181	-0.129	-0.310	-0.173
	(0.0398)	(0.0395)	(0.0492)	(0.0526)	(0.134)	(0.0818)	(0.318)	(0.124)
Post2000 × Supported	0.0519**	0.0471**	0.0385	0.0355	0.0730**	0.102**	-0.00191	0.0992
	(0.0204)	(0.0202)	(0.0261)	(0.0266)	(0.0359)	(0.0412)	(0.0686)	(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	1.619***	1.783***	5.694***	5.796***	1.752***	1.478***	6.150***	5.090***
	(0.0207)	(0.0595)	(0.0298)	(0.124)	(0.122)	(0.120)	(0.312)	(0.260)
R-squared	0.031	0.054	0.080	0.086	0.053	0.265	0.061	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 6. 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 7. Effects of the Five-Year Plan on Taxes, Subsidies and Interest Payments

	Tax Dummy		Tax/Value-added		Subsidy Dummy		Subsidy/Value-added		Interest Payment		Interests/Debt	
VARIABLES	Probit		Tobit		Probit		Tobit		Ordered probit		OLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post2000	0.113***	0.113***	-0.00331***	-0.00331	0.203***	0.203***	0.185***	0.185***	-0.204***	-0.204***	-0.00608*	-0.00608*
	(0.00454)	(0.0176)	(0.000773)	(0.00267)	(0.00536)	(0.0153)	(0.00603)	(0.0220)	(0.00399)	(0.0135)	(0.00990)	(0.00347)
Supported	-0.185***	-0.185**	-0.0309***	-0.0309***	0.0464***	0.0464	0.0393***	0.0393	0.125***	0.125*	-0.000441	-0.000441
	(0.00534)	(0.0762)	(0.000942)	(0.00947)	(0.00653)	(0.0445)	(0.00731)	(0.0429)	(0.00502)	(0.0648)	(0.01197)	(0.00359)
Post2000 × Supported	0.0747***	0.0747**	0.0135***	0.0135***	0.0259***	0.0259	0.0298***	0.0298	-0.0368***	-0.0368	0.0153	0.0153
	(0.00646)	(0.0304)	(0.00113)	(0.00437)	(0.00767)	(0.0352)	(0.00860)	(0.0367)	(0.00591)	(0.0246)	(0.0143)	(0.0116)
Age	0.0125***	0.0125***	0.000799***	0.000799***	0.00678***	0.00678***	0.00681***	0.00681***	0.0121***	0.0121***	-0.000218*	-0.000218*
	(0.000153)	(0.00145)	(2.32e-05)	(0.000195)	(0.000147)	(0.000772)	(0.000163)	(0.000823)	(0.000131)	(0.000691)	(0.00030)	(0.000111)
Export	-0.601***	-0.601***	-0.0595***	-0.0595***	0.282***	0.282***	0.224***	0.224***	-0.134***	-0.134***	-0.0218***	-0.0218***
	(0.00315)	(0.0452)	(0.000582)	(0.00726)	(0.00363)	(0.0366)	(0.00412)	(0.0474)	(0.00287)	(0.0295)	(0.00727)	(0.00757)
State-owned	-0.0550***	-0.0550	0.0118***	0.0118*	0.205***	0.205***	0.257***	0.257***	-0.205***	-0.205***	-0.0287***	-0.0287***
	(0.00548)	(0.0597)	(0.000890)	(0.00666)	(0.00574)	(0.0326)	(0.00635)	(0.0384)	(0.00471)	(0.0398)	(0.01155)	(0.00496)
Cut-point 1	0.818***	0.818***	0.00969***	0.00969	-1.535***	-1.535***	-1.772***	-1.772***	-1.538***	-1.538***	0.0593***	0.0593***
	(0.00430)	(0.0324)	(0.000733)	(0.00756)	(0.00519)	(0.0212)	(0.00705)	(0.173)	(0.00415)	(0.0241)	(0.0094)	(0.00449)
Cut-point 2									-0.493***	-0.493***		
									(0.00385)	(0.0223)		
Sigma			0.235***	0.235***			1.113***	1.113***				
			(0.000201)	(0.0304)			(0.00246)	(0.105)				
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
Cluster	No	Industry	No	Industry	No	Industry	No	Industry	No	Industry	No	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 8, Effects of the Five-Year Plan on Tax Payments

	TFPR top tier				TFPR middle tier				TFPR bottom 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	0.0849***	0.0849***	-0.00691***	-0.00691***	0.0878***	0.0878***	-0.00558***	-0.00558***	0.0995***	0.0995***	0.00211	0.00211
	(0.00790)	(0.0196)	(0.000483)	(0.00127)	(0.00812)	(0.0206)	(0.000617)	(0.00158)	(0.00784)	(0.0194)	(0.00262)	(0.00585)
Supported	-0.202***	-0.202***	-0.0188***	-0.0188***	-0.195***	-0.195**	-0.0219***	-0.0219***	-0.168***	-0.168*	-0.0482***	-0.0482***
	(0.00953)	(0.0682)	(0.000609)	(0.00571)	(0.00945)	(0.0807)	(0.000743)	(0.00751)	(0.00899)	(0.0862)	(0.00309)	(0.0177)
Post2000 × Supported	0.0454***	0.0454	0.00742***	0.00742***	0.0726***	0.0726**	0.00878***	0.00878***	0.0869***	0.0869**	0.0224***	0.0224***
	(0.0111)	(0.0322)	(0.000703)	(0.00252)	(0.0116)	(0.0354)	(0.000909)	(0.00332)	(0.0114)	(0.0384)	(0.00388)	(0.00854)
Age	0.00813***	0.00813***	0.000272***	0.000272	0.0145***	0.0145***	0.000402***	0.000402**	0.0162***	0.0162***	0.00201***	0.00201***
	(0.000264)	(0.00154)	(1.53e-05)	(0.000176)	(0.000277)	(0.00174)	(1.83e-05)	(0.000203)	(0.000259)	(0.00150)	(7.52e-05)	(0.000363)
Export Dummy	-0.476***	-0.476***	-0.0201***	-0.0201***	-0.587***	-0.587***	-0.0322***	-0.0322***	-0.724***	-0.724***	-0.150***	-0.150***
	(0.00516)	(0.0442)	(0.000345)	(0.00284)	(0.00567)	(0.0504)	(0.000469)	(0.00497)	(0.00573)	(0.0491)	(0.00208)	(0.0199)
Ownership	-0.129***	-0.129*	0.00446***	0.00446	-0.0194*	-0.0194	0.00553***	0.00553	0.0178**	0.0178	0.0248***	0.0248***
	(0.00988)	(0.0662)	(0.000606)	(0.00739)	(0.0101)	(0.0667)	(0.000719)	(0.00582)	(0.00889)	(0.0534)	(0.00277)	(0.00833)
Constant	0.981***	0.981***	0.0310***	0.0310***	0.858***	0.858***	0.0295***	0.0295***	0.598***	0.598***	-0.0379***	-0.0379**
	(0.00749)	(0.0286)	(0.000460)	(0.00290)	(0.00770)	(0.0389)	(0.000584)	(0.00368)	(0.00740)	(0.0378)	(0.00248)	(0.0188)
Sigma			0.0890***	0.0890***			0.108***	0.108***			0.435***	0.435***
			(0.000117)	(0.00835)			(0.000165)	(0.0151)			(0.000737)	(0.0631)
Observations	367,703	367,703	367,703	367,703	281,322	281,322	281,322	281,322	251,673	251,673	251,673	251,673
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. 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 9. Effects of the Five-Year Plan on Subsidies

	TFPR top tier				TFPR middle tier				TFPR bottom 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	0.233***	0.233***	0.0609***	0.0609***	0.218***	0.218***	0.126***	0.126***	0.199***	0.199***	0.286***	0.286***
	(0.00990)	(0.0190)	(0.00281)	(0.00716)	(0.00912)	(0.0171)	(0.00648)	(0.0370)	(0.00911)	(0.0188)	(0.0164)	(0.0418)
Supported	0.0646***	0.0646	0.0195***	0.0195	0.0519***	0.0519	0.0274***	0.0274	0.0298***	0.0298	0.0366*	0.0366
	(0.0124)	(0.0426)	(0.00350)	(0.0120)	(0.0110)	(0.0490)	(0.00780)	(0.0314)	(0.0108)	(0.0479)	(0.0194)	(0.0729)
Post2000 × Supported	-0.0104	-0.0104	-0.00448	-0.00448	0.0457***	0.0457	0.0347***	0.0347	0.0724***	0.0724	0.116***	0.116
	(0.0140)	(0.0304)	(0.00395)	(0.00961)	(0.0131)	(0.0412)	(0.00928)	(0.0279)	(0.0132)	(0.0460)	(0.0238)	(0.0722)
Age	0.00598***	0.00598***	0.00161***	0.00161***	0.00617***	0.00617***	0.00376***	0.00376***	0.00660***	0.00660***	0.0106***	0.0106***
	(0.000275)	(0.000889)	(7.70e-05)	(0.000282)	(0.000249)	(0.000892)	(0.000175)	(0.00110)	(0.000248)	(0.000635)	(0.000440)	(0.00121)
Export Dummy	0.301***	0.301***	0.0550***	0.0550***	0.286***	0.286***	0.134***	0.134***	0.222***	0.222***	0.260***	0.260***
	(0.00612)	(0.0336)	(0.00176)	(0.0120)	(0.00626)	(0.0369)	(0.00447)	(0.0508)	(0.00660)	(0.0400)	(0.0119)	(0.0719)
Ownership	0.225***	0.225***	0.0694***	0.0694***	0.168***	0.168***	0.120***	0.120***	0.170***	0.170***	0.366***	0.366***
	(0.0109)	(0.0388)	(0.00305)	(0.00996)	(0.00999)	(0.0341)	(0.00700)	(0.0359)	(0.00934)	(0.0320)	(0.0166)	(0.0604)
Constant	-1.682***	-1.682***	-0.479***	-0.479***	-1.473***	-1.473***	-1.073***	-1.073***	-1.423***	-1.423***	-2.669***	-2.669***
	(0.00960)	(0.0268)	(0.00341)	(0.0453)	(0.00881)	(0.0226)	(0.00748)	(0.309)	0.0724***	(0.0249)	0.116***	(0.276)
Sigma			0.283***	0.283***			0.705***	0.705***			1.791***	1.791***
			(0.00118)	(0.0261)			(0.00264)	(0.197)			(0.00693)	(0.177)
Observations	367,703	367,703	367,703	367,703	281,322	281,322	281,322	281,322	251,673	251,673	251,673	251,673
Cluster	No	Industry	No	Industry	No	Industry	No	Industry	No	Industry	No	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 10. Effects of the Five-Year Plan on Interest Payments

	TFPR top tier				TFPR middle tier				TFPR bottom tier			
	Ordered Probit		OLS		Ordered Probit		OLS		Ordered Probit		OLS	
VARIABLES	Interest Payments		Interests/Debt		Interest Payments		Interests/Debt		Interest Payments		Interests/Debt	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Post2000	-0.238***	-0.238***	-0.00468	-0.00468	-0.193***	-0.193***	-0.0105	-0.0105***	-0.174***	-0.174***	-0.00776***	-0.00776*
	(0.00665)	(0.0160)	(0.0240)	(0.00647)	(0.00707)	(0.0151)	(0.0116)	(0.00378)	(0.00715)	(0.0154)	(0.00286)	(0.00456)
Supported	0.114***	0.114**	0.000147	0.000147	0.134***	0.134*	-0.000971	-0.000971	0.129***	0.129*	0.000198	0.000198
	(0.00859)	(0.0554)	(0.0301)	(0.00536)	(0.00884)	(0.0687)	(0.0139)	(0.00472)	(0.00870)	(0.0721)	(0.00334)	(0.00468)
Post2000 × Supported	-0.0501***	-0.0501	0.0233	0.0233	-0.0181*	-0.0181	0.0104	0.0104	-0.0112	-0.0112	0.000158	0.000158
	(0.00976)	(0.0341)	(0.0347)	(0.0223)	(0.0106)	(0.0253)	(0.0169)	(0.0137)	(0.0107)	(0.0273)	(0.00421)	(0.00462)
Age	0.0128***	0.0128***	0.000132	0.000132	0.0108***	0.0108***	-0.000519	-0.000519***	0.0120***	0.0120***	-4.28e-05	-4.28e-05
	(0.000223)	(0.000839)	(0.000763)	(0.000320)	(0.000231)	(0.000744)	(0.000347)	(0.000126)	(0.000232)	(0.000634)	(8.46e-05)	(5.70e-05)
Export Dummy	-0.116***	-0.116***	-0.0248	-0.0248	-0.102***	-0.102***	-0.0198**	-0.0198***	-0.200***	-0.200***	-0.0132***	-0.0132***
	(0.00451)	(0.0256)	(0.0168)	(0.0176)	(0.00519)	(0.0322)	(0.00861)	(0.00651)	(0.00540)	(0.0372)	(0.00219)	(0.00255)
Ownership	-0.298***	-0.298***	-0.0498*	-0.0498***	-0.186***	-0.186***	-0.0188	-0.0188***	-0.160***	-0.160***	-0.0116***	-0.0116***
	(0.00824)	(0.0437)	(0.0301)	(0.0120)	(0.00848)	(0.0438)	(0.0136)	(0.00308)	(0.00799)	(0.0365)	(0.00311)	(0.00221)
Cut point 1	-1.639***	-1.639***			-1.508***	-1.508***			-1.448***	-1.448***		
	(0.00692)	(0.0244)			(0.00734)	(0.0271)			(0.00741)	(0.0258)		
Cut point 2	-0.458***	-0.458***			-0.547***	-0.547***			-0.507***	-0.507***		
	(0.00640)	(0.0220)			(0.00683)	(0.0242)			(0.00692)	(0.0256)		
Constant			0.0710***	0.0710***			0.0602***	0.0602***			0.0378***	0.0378***
			(0.0228)	(0.00504)			(0.0110)	(0.00684)			(0.00271)	(0.00598)
Observations	367,703	367,703	367,703	367,703	281,322	281,322	281,322	281,322	251,673	251,673	251,673	251,673
Cluster	No	Industry	No	Industry	No	Industry	No	Industry	No	Industry	No	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.

6 Appendix

A. 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.

Figure A.1. Un-normalized mean and variance of TFPR and TFPQ

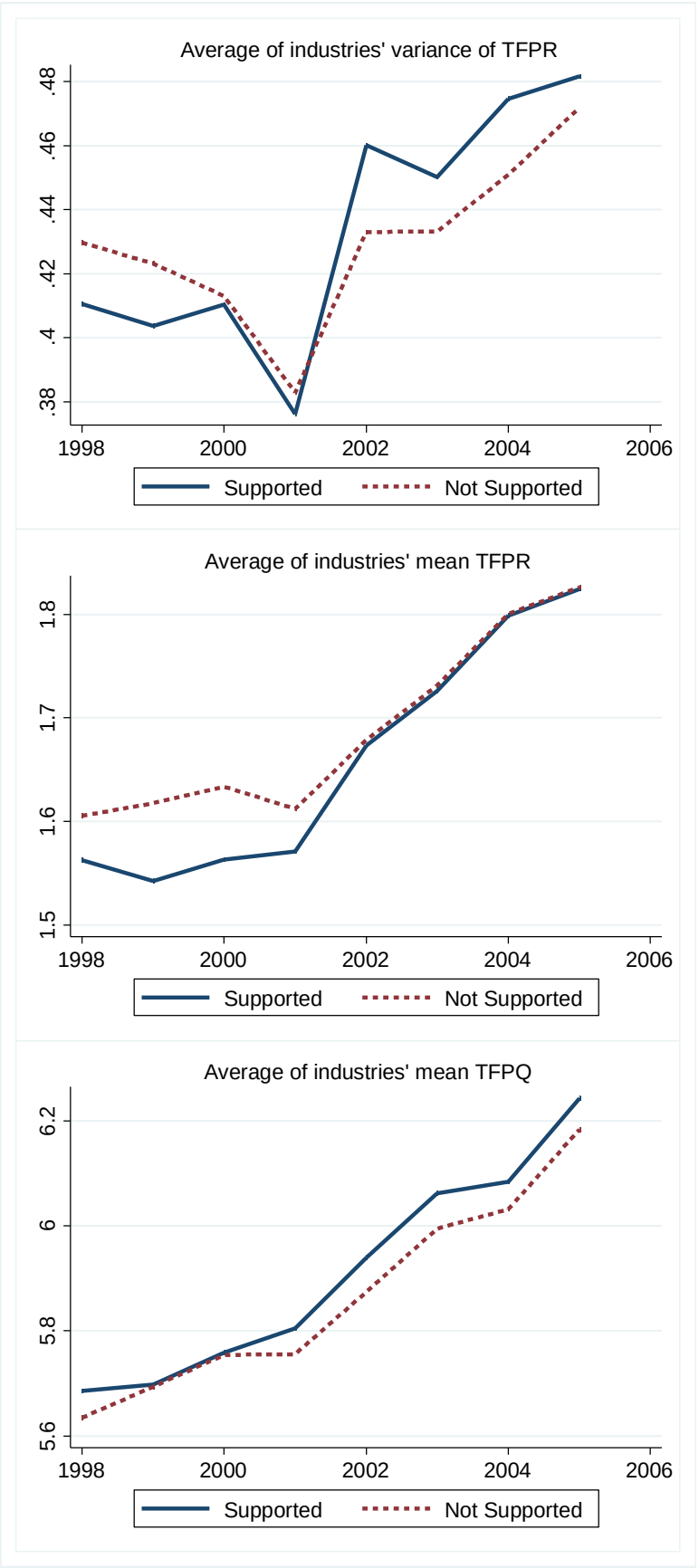


Table A.2. Effects of the 10th Five-Year Plan on the Dispersion of TFPR, Controlling for the Variance of Firms' Characteristics

VARIABLES	OLS			WLS		
	V(TFPR)	90th -10th	75th -25th	V(TFPR)	90th -10th	75th -25th
	(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×Supported	0.0328**	0.0819***	0.0506***	0.0860***	0.196***	0.115***
	(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). 90th -10th and 75th -25th denote the difference in log(TFPR) values between the 90th and the 10th percentile and between the 75th and the 25th 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 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 A.3. Robustness Check of Pre- and Post- Treatment Effects

VARIABLES	OLS						WLS					
	V(TFPR)	90^{th} -10^{th}	75^{th} -25^{th}	V(TFPR)	90^{th} -10^{th}	75^{th} -25^{th}	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)	(7)	(8)	(9)	(10)	(11)	(12)
Supported × 1999	-.000369	-0.0229	-0.0240	-.000135	-.0248	-.0237	-0.0426	-0.0496	-0.0409	-0.0438	-0.0537	-0.0434
	(0.0157)	(0.0402)	(0.0198)	(0.0156)	(0.0399)	(0.0195)	(0.0386)	(0.0602)	(0.0391)	(0.0390)	(0.0597)	(0.0396)
Supported × 2000	0.0164	-0.00126	-0.0127	0.0175	-7.38e-05	-0.0107	0.00248	0.0152	-0.0279	0.000265	0.0125	-0.0310
	(0.0162)	(0.0405)	(0.0192)	(0.0162)	(0.0405)	(0.0191)	(0.0322)	(0.0812)	(0.0505)	(0.0332)	(0.0821)	(0.0527)
Post2000×	0.0333**	0.0615	0.0314	0.0333**	0.0628	0.0318	0.0327	0.0966*	0.0495	0.0266	0.0892	0.0388
Supported	(0.0160)	(0.0389)	(0.0206)	(0.0157)	(0.0385)	(0.0204)	(0.0238)	(0.0582)	(0.0329)	(0.0250)	(0.0564)	(0.0340)
V(Age)				3.84e-05	-7.16e-05	2.64e-05				0.000264**	0.000324	0.000113
				(7.91e-05)	(0.000178)	(9.89e-05)				(0.000117)	(0.000242)	(0.000172)
V(Export/VA)				-2.3e-7***	-9.9e-7***	-4.3e-7***				-3.1e-7***	-9.6e-7***	-4.8e-7***
				(3.65e-08)	(9.34e-08)	(5.60e-08)				(7.62e-08)	(1.54e-07)	(7.68e-08)
V(SOE share)				-0.198	-0.173	-0.334**				-0.519***	-0.634**	-0.611***
				(0.123)	(0.287)	(0.162)				(0.152)	(0.312)	(0.162)
Constant	0.858***	2.498***	1.302***	0.894***	2.561***	1.374***	0.850***	2.461***	1.281***	0.897***	2.519***	1.395***
	(0.0105)	(0.0264)	(0.0125)	(0.0315)	(0.0746)	(0.0396)	(0.0177)	(0.0475)	(0.0257)	(0.0386)	(0.0728)	(0.0500)
R-squared	0.856	0.832	0.813	0.857	0.832	0.814	0.904	0.898	0.882	0.906	0.900	0.885

Notes: V(TFPR) denotes the variance of log(TFPR). WLS regressions are weighted by the industry's share of value-added. 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. 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.4 Effects of the Five-Year Plan on Taxes, Subsidies and Interest Payments

	TFPR top tier				TFPR middle tier				TFPR bottom tier			
	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	0.0642***	0.0642***	0.00755***	0.00755***	0.0563	0.0563***	0.0561	0.0561***	-0.0144**	-0.0144	.0198	.0198
	(0.00670)	(0.0229)	(0.00113)	(0.00266)	(0.0405)	(0.00789)	(0.0398)	(0.00878)	(0.00605)	(0.0213)	(.01459)	(.01358)
Age	0.0103***	0.0103***	0.000516***	0.000516***	0.00662***	0.00662***	0.00663***	0.00663***	0.0110***	0.0110***	-.0002	-.0002
	(0.000160)	(0.00107)	(2.36e-05)	(0.000107)	(0.000472)	(0.000155)	(0.000679)	(0.000171)	(0.000136)	(0.000659)	(.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)	(0.000643)	(0.00632)	(0.0184)	(0.00420)	(0.0333)	(0.00474)	(0.00327)	(0.0156)	(.0082)	(.0057)
Ownership	0.00391	0.00391	0.00903***	0.00903**	0.188***	0.188***	0.237***	0.237***	-0.214***	-0.214***	-.0364***	-.0364***
	(0.00586)	(0.0464)	(0.000910)	(0.00382)	(0.0220)	(0.00605)	(0.0301)	(0.00664)	(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 A5 Effects of the Five-Year Plan on Tax Payments

	TFPR top tier				TFPR middle tier				TFPR bottom 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	0.0391***	0.0391	0.00430***	0.00430***	0.0674***	0.0674**	0.00346***	0.00346**	0.0681***	0.0681**	0.0106***	0.0106*
	(0.0115)	(0.0255)	(0.000666)	(0.00148)	(0.0121)	(0.0290)	(0.000851)	(0.00166)	(0.0119)	(0.0274)	(0.00393)	(0.00576)
Age	0.00593***	0.00593***	2.72e-05*	2.72e-05	0.0118***	0.0118***	0.000155***	0.000155**	0.0144***	0.0144***	0.00163***	0.00163***
	(0.000277)	(0.00122)	(1.47e-05)	(6.54e-05)	(0.000293)	(0.00141)	(1.75e-05)	(6.99e-05)	(0.000273)	(0.00109)	(7.71e-05)	(0.000292)
Export Dummy	-0.454***	-0.454***	-0.0163***	-0.0163***	-0.570***	-0.570***	-0.0269***	-0.0269***	-0.685***	-0.685***	-0.137***	-0.137***
	(0.00602)	(0.0248)	(0.000365)	(0.00124)	(0.00663)	(0.0289)	(0.000489)	(0.00256)	(0.00654)	(0.0276)	(0.00229)	(0.0182)
Ownership	-0.0803***	-0.0803	-0.00292***	-0.00292	0.0476***	0.0476	0.00104	0.00104	0.0738***	0.0738**	0.0261***	0.0261***
	(0.0106)	(0.0561)	(0.000588)	(0.00226)	(0.0109)	(0.0538)	(0.000691)	(0.00236)	(0.00955)	(0.0341)	(0.00286)	(0.00565)
Constant	0.478***	0.478***	0.0119***	0.0119***	0.230***	0.230***	0.00149	0.00149	-0.107***	-0.107***	-0.168***	-0.168***
	(0.0191)	(0.0236)	(0.00120)	(0.00257)	(0.0207)	(0.0359)	(0.00161)	(0.00488)	(0.0222)	(0.0272)	(0.00804)	(0.0304)
Sigma			0.0828***	0.0828***			0.0996***	0.0996***			0.431***	0.431***
			(0.000109)	(0.00653)			(0.000152)	(0.0133)			(0.00073)	(0.0635)
Observations	367,703	367,633	367,703	367,703	281,322	281,322	281,322	281,322	251,673	251,673	251,673	251,673
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 A6 Effects of the Five-Year Plan on Subsidies

	TFPR top tier				TFPR middle tier				TFPR bottom 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	0.0283*	0.0283	0.00756*	0.00756	0.0793***	0.0793*	0.0535***	0.0535*	0.0877***	0.0877**	0.135***	0.135**
	(0.0145)	(0.0382)	(0.00401)	(0.0119)	(0.0135)	(0.0439)	(0.00946)	(0.0295)	(0.0137)	(0.0439)	(0.0244)	(0.0666)
Age	0.00553***	0.00553***	0.00144***	0.00144***	0.00577***	0.00577***	0.00337***	0.00337***	0.00675***	0.00675***	0.0108***	0.0108***
	(0.000292)	(0.000546)	(8.02e-05)	(0.000193)	(0.000265)	(0.000579)	(0.000184)	(0.000925)	(0.000260)	(0.000467)	(0.000459)	(0.00115)
Export Dummy	0.364***	0.364***	0.0739***	0.0739***	0.368***	0.368***	0.184***	0.184***	0.316***	0.316***	0.393***	0.393***
	(0.00718)	(0.0194)	(0.00203)	(0.00870)	(0.00731)	(0.0186)	(0.00517)	(0.0554)	(0.00756)	(0.0229)	(0.0136)	(0.0506)
Ownership	0.174***	0.174***	0.0552***	0.0552***	0.146***	0.146***	0.102***	0.102***	0.164***	0.164***	0.345***	0.345***
	(0.0117)	(0.0266)	(0.00318)	(0.00826)	(0.0106)	(0.0236)	(0.00733)	(0.0284)	(0.00985)	(0.0214)	(0.0173)	(0.0459)
Constant	-2.057***	-2.057***	-0.564***	-0.564***	-1.925***	-1.925***	-1.336***	-1.336***	-1.677***	-1.677***	-3.044***	-3.044***
	(0.0300)	(0.0268)	(0.00855)	(0.0542)	(0.0295)	(0.0350)	(0.0213)	(0.379)	(0.0286)	(0.0312)	(0.0523)	(0.304)
Sigma			0.279***	0.279***			0.698***	0.698***			1.781***	1.781***
			(0.00115)	(0.0259)			(0.00260)	(0.197)			(0.00688)	(0.177)
Observations	367,703	367,703	367,703	367,703	281,322	281,322	281,322	281,322	251,673	251,673	251,673	251,673
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 A7 Effects of the Five-Year Plan on Interest Payments

	TFPR top tier				TFPR middle tier				TFPR bottom 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	-0.0234**	-0.0234	0.0285	0.0285	0.00728	0.00728	0.0154	0.0154	-0.00592	-0.00592	-0.000781	-0.000781
	(0.0100)	(0.0239)	(0.0354)	(0.0250)	(0.0109)	(0.0238)	(0.0172)	(0.0184)	(0.0111)	(0.0229)	(0.00428)	(0.00374)
Age	0.0113***	0.0113***	5.21e-05	5.21e-05	0.00970***	0.00970***	-0.000589	-0.000589***	0.0112***	0.0112***	-1.87e-05	-1.87e-05
	(0.000231)	(0.000795)	(0.000789)	(0.000272)	(0.000241)	(0.000742)	(0.000362)	(0.000226)	(0.000241)	(0.000590)	(8.73e-05)	(5.49e-05)
Export Dummy	0.00554	0.00554	-0.0147	-0.0147	-0.00314	-0.00314	-0.0173*	-0.0173***	-0.0985***	-0.0985***	-0.0116***	-0.0116***
	(0.00519)	(0.0120)	(0.0192)	(0.0144)	(0.00596)	(0.0174)	(0.00979)	(0.00510)	(0.00612)	(0.0233)	(0.00244)	(0.00242)
Ownership	-0.300***	-0.300***	-0.0610*	-0.0610***	-0.197***	-0.197***	-0.0259*	-0.0259***	-0.179***	-0.179***	-0.0138***	-0.0138***
	-0.0234**	(0.0312)	0.0285	(0.0206)	0.00728	(0.0298)	0.0154	(0.00686)	-0.00592	(0.0249)	-0.000781	(0.00327)
Cut-point 1	-2.076***	-2.076***			-1.883***	-1.883***			-1.691***	-1.691***		
	(0.0187)	(0.0215)			(0.0213)	(0.0226)			(0.0230)	(0.0218)		
Cut-point 2	-0.859***	-0.859***			-0.894***	-0.894***			-0.721***	-0.721***		
	(0.0185)	(0.0158)			(0.0211)	(0.0191)			(0.0228)	(0.0207)		
Constant			0.393***	0.393***			0.108***	0.108***			0.0608***	0.0608***
			(0.0632)	(0.0155)			(0.0322)	(0.00816)			(0.00862)	(0.00143)
Observations	367,703	367,703	367,703	367,703	281,322	281,322	281,322	281,322	251,673	251,673	251,673	251,673
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.