Costly Labor Adjustment: General Equilibrium Effects of China's Employment Regulations and Financial Reforms*

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Abstract

This paper studies the employment and productivity implications of new Chinese labor regulations intended to protect workers' employment conditions. We estimate a general equilibrium model of costly labor adjustment from data prior to the policy. Using the estimated parameters, we study the effects of the interventions. Increases in severance payments are particularly effective and lead to sizable private sector responses including: an increase in firm size, lower employment, reduced labor reallocation, and a decrease in number of active firms. If in place at the time, these frictions would have reduced China's annual growth rate by nearly 1 percentage point between 1998 and 2007, a period of intense privatization. A policy of credit market liberalization is very powerful. It reduces private firm size and increases private sector employment, labor reallocation, wages and output.

1 Motivation

The rise of China as a major global economic power is a significant phenomenon. As emphasized by Hsieh and Klenow (2009), the rapid growth in China reflects, in part, the reallocation of factors of production to more productive uses. This reallocation occurred between public and private firms and within these ownership classes. Misallocation due to the presence of publicly owned firms fell between 1998 and 2005.[1]

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[1]See the discussion in section VI of Hsieh and Klenow (2009).

This finding is consistent with the evidence presented in Cooper, Gong, and Yan (2015) that the gap between private and public plants narrowed by 2005-2007.

More recently a countervailing influence appeared. Along with the rapid growth in China, concerns grew over poor labor conditions, including job security and wage levels.[2] In January 2008, China adopted a new labor law intended to enhance workers' rights. Table 1 in Allard and Garot (2010) compares the scores of different countries on the Employment Protection legislation indicator, developed by the OECD to gauge the strictness of labor laws. From that table, the new law moves China from a fairly deregulated labor market to one as restrictive as some of the most protective European economies, and much more restrictive than the United States.[3]

While potentially desirable as a device to protect workers, these types of policies can limit reallocation and thus retard economic growth. The gains from reallocation highlighted by Hsieh and Klenow (2009) are at risk due to these interventions. The potential effects of these policies on growth in China was a key point in an April 2015 speech by former Finance Minister Lou Jiwei at Tsinghua University who said:[4]

> The labor law implemented in January 2008 has obvious drawbacks. The drawbacks are mainly due to reduced mobility and flexibility in the labour market. Employees can fire (an) employer, but the employer cannot easily dismiss a worker, ...

Lou compared the reduction in labor market flexibility to the rigidity of labor markets in parts of Europe and Detroit. His comments tied the labor regulations to growth in China, warning of the prospect of China being stuck in a "middle-income trap".

Under the new law, employers are not allowed to unilaterally terminate employees' contracts and are required to make severance payments for dismissals. The new law also includes restrictions on collective dismissals, which arise when an employer dismisses 10% or more of the work force (or 20 or more employees). A mass layoff can be conducted if the company is experiencing severe financial, production or operation problems or is undergoing a major transformation. Other provisions of the law are detailed below.

In addition to labor market reform, in March 2016, China's lawmakers passed the 13th Five-Year Plan, a blueprint for the nation's development from 2016 to 2020. A significant target claimed in the plan is to reform the Chinese financial system, improve the efficiency of financial services, and reduce the financing costs for small- and medium-sized enterprises. Two major measures of improving credit access for private enterprises are interest rate liberalization and banking deregulation. As we shall see, these credit market reforms are vastly more powerful than the labor market protection measures.

To evaluate these policies, we study a general equilibrium model in which households and firms interact in a labor market, constrained by the various components of the new labor law.[5] We estimate both

[2] These concerns include outright labor abuse. In June 2007, the media reported a labor scandal that kept thousands of labor in slavery in small brick kilns in Shanxi Province, Central China.

[3] In 2012 China ranked first according to the OECD "strictness of employment protection" index. Thanks to one of the referees for bringing this fact to our attention.

[4] For a full version of Lou's speech (in Chinese), see: `http://www.sem.tsinghua.edu.cn/portalweb/sem?__c=fa1&u=xyywcn/69292.htm`.

[5] Our earlier analysis, Cooper, Gong, and Yan (2012) was entirely partial equilibrium in nature.

household and plant-level parameters, using observations prior to the labor regulations. For plants, we estimate the revenue function, the driving process for the shocks to profitability, the adjustment costs as well as the discount factor. Since there is entry and exit of plants, we also estimate fixed production and entry costs. For households, we estimate the disutility from work. The estimation uses the allocation of a stationary general equilibrium as a basis for inference. Compared to the emphasis on implicit wedges in Hsieh and Klenow (2009), this analysis has a couple of novel components: the adjustment frictions are explicit, the analysis is dynamic and we study an equilibrium outcome.

The estimates of structural parameters from the model are used for the policy analysis. The job protection measures we consider include: (i) the increase of fixed firing costs, (ii) increased costs of varying worker hours (overtime provisions), (iii) increases in severance pay and (iv) increases in social security payments. We study how these policy interventions influence steady state levels of firm size, aggregate employment, worker reallocation and aggregate productivity.[6]

We supplement the consideration of labor market interventions with an analysis of credit market interventions. In the same speech as quoted above, former Finance Minister Lou said:

> In implementing these reforms, two issues must be handled with care. First, deleveraging and liberalizing the capital market by introducing more means of financing.

In our estimation, and consistent with other studies of capital market frictions in China, private firms tend to discount the future more than public ones.[7] The interaction between labor and credit policies is key: **the response to the labor reforms depends critically on the discount factor of firms**.[8]

A main effect of the interventions on labor demand **on private plants** comes through increased severance payments and the liberalization of capital markets. At given wages, increased severance payments lead to an **increase** in average plant size and a reduction in productivity, since reallocation is more costly. We find that this effect is directly related to our estimated discount factor of about 0.92 for private plants. With this relatively low discount factor, a plant will expand employment and output in response to a favorable shock and then hold onto these extra workers in bad times due to the higher firing costs. This effect on firm size is muted when capital markets are liberalized and the discount factor rises to 0.95.

The general equilibrium analysis adds entry of private firms as well as market clearing wage variations in response to the policy interventions. The analysis focuses on the response to these interventions in the private sector, given the public sector wage and employment. Relative to the direct effect on private plant labor demand, the increased severance pay has about the same positive impact on private firm size while credit market liberalization has a large negative effect on firm size. In addition, the increased severance payments lead to a reduction in the number of private firms and a reduction in private sector employment while credit market liberalization increases the number of firms and aggregate employment. In a general

[6] Throughout we distinguish the effects of the policy on average firm size and total employment, i.e. the equilibrium participation rate of the representative household.

[7] This comparison and a discussion of related literature is contained in Cooper, Gong, and Yan (2015).

[8] In a model with labor and financial market search, Petrosky-Nadeau and Wasmer (2013) emphasize this interaction as well.

equilibrium setting, attempts to increase the social security contributions are offset by equilibrium wage responses, leaving the allocation unchanged.

From the general equilibrium analysis of the private sector, the 20% increase in severance payments leads to a 2% decline in productivity, and nearly a 15% reduction in output. These losses come from the reduction in worker mobility. A 20% increase in the cost of adjusting labor hours reduces productivity by 4.8%, and output falls by 7.5%. By limiting the response of hours to shocks, the reallocation of the labor input is hampered. The liberalization of credit market leads, by reducing interest rates, to an output gain of about 43%.

The fact that the model is estimated is important for these findings since the effects of the policies depend on the underlying parameters of adjustment costs and discount factor. This is particularly noteworthy in understanding the effects of increased severance pay. As we shall see, the estimation uncovers a relatively low value of the discount factor for private firms, which interacts with the policy effects. Naturally, an increase in severance pay will have two opposing effects. One is to reduce job destruction since it is more expensive to fire workers. The other is to reduce job creation since, given that firing is costly, firms are reluctant to hire workers. The overall effect on firm size is ambiguous.

Our findings are consistent with the existing empirical results in the literature. Building on a partial equilibrium framework, Bentolila and Bertola (1990) claim that firing costs could increase firm size by making firms hoard labor. Hopenhayn and Rogerson (1993) develop a general equilibrium model to show that general equilibrium wage adjustments through the labor supply response matters. They find that an increase in firing costs reduces aggregate employment and increases firm size. From simulations of our estimated model, private firm size can grow after an increase in severance pay, a finding attributed to the **estimated** low discount factor of private firms.

Further, we study how the policy interacts with a couple of distinguishing features of the Chinese economy. First, we consider the large role played by the state sector. Second, we distinguish plants who export from those who don't.

We use the estimated model, along with estimates of the adjustment cost and other parameters for state controlled enterprises (SCE) to study the privatization in China between 1998 and 2007. This was a period, when, according to Hsieh and Klenow (2009), Chinese growth was facilitated by reallocation. We study how the introduction of labor market reforms would have reduced output relative to the baseline. We find that the introduction of job protection measures, principally severance pay, would have slowed privatization and thus limited the productivity gains from this policy. But, credit market liberalization would have increased the productivity gains from the shedding of workers by the public sector.

The comparison of public and private plants is noteworthy in part due to the estimated differences in discount factors. The more patient public (state controlled) plants respond differently than the private plants to an increase in severance pay. This policy leads to an increase in the employment share of private plants as they discount the future more than public plants. Analysis of plant data after the introduction of the policy is consistent with this prediction of the model.

China is a very open economy. In 2007, about 25% or 78,800 of plants were exporters, accounting for

52% of industrial production and employing about 50% of the workers.[9] China has emerged as the world's largest manufacturer and merchandise exporter, accounting for more than 10% of world merchandise export sales.[10] We study how the introduction of the labor laws will have a differential impact on exporting plants, largely because the discount rate for exporters is higher.

This is certainly not the first paper to study the effects of labor market interventions. There are a couple of features that make our analysis noteworthy. First, the paper is about labor market interventions in China. While the fact that a communist country finds it necessary to impose labor market protections is of significance, our analysis goes beyond the resulting redistribution effects to focus more on the implications of these policies for productivity. Reallocation has been key to China's economic success and interventions of this form can lead to output and productivity reductions.

Second, besides a different focus, this paper combines estimation with policy analysis in a general equilibrium model. While the focus of the estimation is on a plant-level optimization problem, household preferences and the plant entry cost are inferred from equilibrium conditions.

2 China's Labor Policies

China's labor markets and its labor policies have experienced tremendous changes in the last three decades. Prior to the early 1980s, there were few private firms. Nearly all workers worked in the state sector through government assignment. Employment was lifelong, from cradle to grave. Hours variation was minimal. Employment could not be terminated and benefits to employees were secured regardless of their productivity or the firm's profitability. This system was often referred to as the "Iron Rice Bowl".

An initial labor law, effective January 1995, was enacted during China's market transition. The law replaced the Iron Rice Bowl with contract-based employment and the labor market began to substitute for government job assignment. From the perspective of employment protection, the 1995 law was relatively flexible. The provisions were vague and lax. These loosely worded provisions were proposed to release enterprises from the original restrictions, and served to promote business freedom.

The new labor law enacted in 2008 marked a major step in the direction of a rigid labor market in China. These reforms, termed the "Labor Contract Law of the People's Republic of China" were passed on June 29, 2007 and were effective January 1, 2008.[11] The law requires employers to provide employees with written contracts that contain the term of employment, job description, place of work, working hours, rest and leave periods, wages, social insurance, labor protections, and description of working conditions.

As stated in the first chapter of the law:

> Article 1 This Law is formulated to improve the labor contract system, to specify the rights and obligations of the parties to labor contracts, to protect the legitimate rights and interests

[9] Authors' calculations, based on micro-data from Annual Surveys of China's Industrial Production.

[10] The data come from the World Trade Organization (WTO).

[11] This discussion draws on presentation of the new laws at http://hi.baidu.com/yanyulou/blog/item/1ebba9648ab5f7f3f6365430.html.

> of workers, and to build and develop harmonious and stable employment relationships.
>
> Article 2 This Law applies to the establishment of labor relationships between, the conclusion of, performance of, amendment of, revocation of and termination of, labor contracts by workers and organizations such as enterprises, individual economic organizations and private non-enterprise units in the People's Republic of China (Employers).
>
> The conclusion, performance, amendment, revocation and termination of labor contracts between state authorities, institutions or social organizations and workers with whom they establish employment relationships, shall be subject to this law.

The specifics needed to implement these goals are contained in Chapter IV of the new law. One of the most economically important provisions is the requirement of severance payment upon separation. Before the implementation of the new law, the employer was not required to provide a severance payment if an existing employment contract expired without being renewed. The law stipulates that for lawfully terminated contracts the severance pay is one month's salary for each year of employment, capped at 12 months or 12 times 300% of the local average monthly salary, whichever is bigger. The severance is twice this amount if a contract is terminated unlawfully.

Our estimates of adjustment costs prior to the introduction of the new law includes a significant fixed cost of firing. In our policy analysis we amend the specification of the fixed firing costs from the new law following this provision:

> Article 41 If any of the following circumstances make it necessary to reduce the workforce by 20 persons or more, or less than 20 persons but accounting for 10% or more of the total number of employees of the Employer, the Employer may only do so after it has explained the situation to the labor union or to all of its employees 30 days in advance, has considered the opinions of the labor union or the employees, and has submitted its workforce layoff plan to the labor administrative department ...

Though the new regulations apply to both private and public firms, we focus on the private plants in our study as they are most likely to be influenced by these new policies. By the end of 2006, almost 100% of employees in state-owned and state-controlled enterprises had signed labor contracts with their employers. This fraction is less than 40% for private, especially domestic private enterprises.[12] The private plants account for over 75% of total employment.

As with any new regulation, there is the open question of enforcement. One of the most prominent features of the Labor Contract Law is the mandatory requirement of written contracts at the commencement of labor relationship (Article 7) or within one month thereafter (Article 10). Without a written contract, it is difficult for workers to claim legal rights when labor disputes arise. The progress made by the Labor Contract Law is that, it provides penalties for employers who do not sign written contracts with their employees.

There is some evidence that the new regulations have been effective. The Ministry of Human Resources and Social Security of China stated that labor disputes in 2008 rose to 693,000, a near doubling of cases

[12] Source: `http://www.ycwb.com/xkb/2006-07/27/content_1172744.htm`.

from 2007. From the U.S. Congressional Commission on China, this rapid rate of increase is continuing and that the explosion of disputes is particularly apparent in coastal cities and provinces, including Beijing, Shanghai, Jiangsu, Zhejiang and Guangdong.[13]

To provide further evidence, we conducted an informal survey of plants and the New Labor Contract Law (NLCL).[14] Responses are summarized in Table 1.

Table 1: Survey Responses

	much more difficult	more difficult	no change	easier
NLCL makes recruitment	8	1	3	0
NLCL makes firing	1	7	4	0
NLCL increases average	>30%	20 to 30%	10 to 20%	< 10%
labor cost by	4	8	0	0
Law authorities inspect	very strictly	strictly	not strictly	
implementation of NLCL	5	6	1	

When asked about which provisions of the NLCL affect enterprises most, responses included:

- Enterprises are required to make all employees insured. The base insurance payment increases every year, making the cost of doing business increase every year.
- The minimum wage increases steadily every year.
- Recruitment becomes difficult. In the meantime, labor mobility is very large. The newly hired students cannot and do not want to do hard work.
- The restriction on working hours in New Labor Contract Law imposes huge cost on the apparel industry. The special nature of apparel industry is that the working hours are relatively long; most enterprises export goods to other countries. They have to complete the production in a pressing time, which usually makes employees work extra hours.
- Article 38 where the enterprises are enforced to pay social security insurance for all employees.

Given the size of the survey, the results are only suggestive of the reforms and their enforcement. Yet it does seem that the costs of hiring and firing workers have increased as have labor costs. Moreover, from both the survey and the evidence of labor market strife, the new regulations are being enforced.[15] According to the vice president of the All China Federation of Trade Unions, "Two months after the enactment of the Labor Contract Law, the percentage of workers who have signed labor contracts with their employers has reached 80-90%."[16]

[13]The quote comes from the U.S. Congressional Executive Commission on China, 2009 Annual Report, p. 75., available at `http://www.cecc.gov/`.

[14]Thus far, 12 enterprises replied to the survey, located in 6 provinces: Jiangsu, Shandong, Zhejiang, Henan, Sichuan, and Heilongjiang.

[15]Freeman and Li (2013) study the effects of the law on migrant workers and find evidence that these laws are enforced and matter for these workers.

[16]Source: `http://yt.tmjob88.com/ViewArticle.php?id=13920`.

3 Model Economy

We consider the general equilibrium of a large economy composed of competitive households and plants (firms). The main action in the model comes from the dynamic labor demand of the heterogeneous producers, both in terms of productivity and ownership, i.e. both state controlled enterprises and privately owned plants are included in the analysis..

The households supply labor to firms. The households also own the private firms, though the labor supply decisions are made independently of ownership. As detailed below, the households have heterogenous labor market outcomes. Some are employed, others are not. Among those employed, hours worked may vary across firms.

The analysis is not about these differences in households. While risk sharing opportunities are certainly limited, the effects of the policies we consider are more directly associated with labor demand. Thus, we follow Hopenhayn and Rogerson (1993) and consider a single household within which the risks of these heterogeneous outcomes are shared.

To study the determination of employment and wages with both public and private plants, we adopt a segmented labor markets structure. The state controlled enterprises dominate the labor market. The compensation functions set by these plants are determined by policy, not by the market. Given the cost of labor, the public sector plants choose employment. The private sector equilibrium is determined given the outcome of the public sector.

This segmentation is important for our empirical analysis of the policy interventions. The private sector plants are the treatment group, with the job protection measures directly applied to them. The public sector plants represent the control group, neither directly impacted by the policy nor responding to it through the general equilibrium response of endogenous variables.

As there are no aggregate shocks in the model, it is relatively straightforward to find a stationary equilibrium. To be clear, in this equilibrium the state of an individual firm is stochastic due to idiosyncratic shocks and differences in employment. Yet, in aggregate, the economy is in a steady state.

3.1 Firm Dynamic Optimization

In this section we present the dynamic optimization problem of private and public plants.[17] The optimization problem is the basis of our estimation using the simulated method of moments approach. The policy changes are then evaluated using the estimated parameters.

3.1.1 Private Plants

The dynamic optimization problem for a privately owned (controlled) plant builds from the specification in Cooper, Haltiwanger, and Willis (2015) and Cooper, Gong, and Yan (2015). At a point in time, the plant is in state (A, e_{-1}) where A is a random variable representing the profitability of the plant and e_{-1}

[17]When necessary, we use superscripts p and s to denote private sector and state sector, respectively.

is the stock of workers employed in the previous period.[18]

At the start of a period, the plant will either continue in operation or exit. As there is no capital, we set the value of exit to 0, assuming that any severance pay requirements are not enforceable on a plant that exits.[19]

$$V(A, e_{-1}) = \max\{V^c(A, e_{-1}), 0\}. \tag{1}$$

Here $V(A, e_{-1})$ is the state contingent value of the plant and $V^c(A, e_{-1})$ is the value if it continues in operation, retaining the option of exit in the future.

A continuing plant chooses the number of workers to employ in the current period, e, along with the hours per worker, h. These choices are made to maximize the sum of current profits and the discounted expected value of the firm in the next period. Current profits are defined as revenues less compensation paid to workers and less costs of adjusting the workforce.[20]

The value of the continuing plant in state (A, e_{-1}) is given by

$$V^c(A, e_{-1}) = \max_{h,e} R(A, e, h) - e\omega^p(h) - \omega_0^p\Gamma - C(e_{-1}, e) + \beta E_{A'|A}V(A', e) \tag{2}$$

for all (A, e_{-1}). Here $R(A, e, h)$ is the revenue flow of a plant with e workers, each working h hours in profitability state A. Our analysis assumes that the profitability shock is plant-specific.[21] Both private sector hours dependent total compensation, $\omega^p(h)$, and the base wage, ω_0^p, are determined in equilibrium.

Revenue depends on the product of hours per worker and the number of workers. This function comes from the product of a production function and the demand function facing the plant. Factors of production other than labor, such as capital and energy, are freely adjustable within a period. With constant returns to scale and constant elasticity of demand, the revenue function takes the form in (3). The coefficient α reflects the curvature of the production function along with the elasticity of demand. The parameter A represents both shifts in the production function of a plant, shifts in factor prices and shifts in the demand for that plant's output:

$$R(A, e, h) = A(eh)^\alpha. \tag{3}$$

In (2), there is a fixed cost of operation, denoted Γ, denominated in units of labor input and thus multiplied by the base wage, ω_0^p. As we observe exit in the data, the presence of Γ will help match that moment. In the policy experiments that follow, the overhead cost will respond to variations in the base wage.

The dependence of compensation on hours, given by $w^p(h)$, is an important determinant of how the firm varies its labor input in response to a change in profitability. Does the reaction occur through variations in

[18] For this part of the analysis, A is drawn from a stationary process. We discuss growth in Section 5.5.1.

[19] This differs from the specification in Hopenhayn and Rogerson (1993) where firms that exit must pay a firing cost. We study this alternative case in sub-section 5.5. Thanks to Immo Schott for bringing this issue to our attention.

[20] As discussed in the empirical implementation, the data counterpart of this are revenues net of other costs of production.

[21] The model is estimated from cross sectional variation by removing year effects. The overhead and entry costs are specified in terms of labor units and hence multiplied by the base wage.

hours or in the number of workers? Though hours are not measured in our data, it is important to include this margin in the model. In theory, one of the effects of an increased firing cost is to reduce the variability of employment and instead to rely on hours variation in response to profitability shocks. In fact, hours variation was historically small in China prior to the reforms in the late 1970s, when almost all enterprises were public. In contrast, a post-reform survey of Chinese households in 2013 shows significant variation in hours over the week and the day. For example, the median days worked per week is 6, but the first quartile of the workers report only 5 days of work and the third quartile report 7 days.[22]

The cost of adjusting the stock of workers is given by $C(e_{-1}, e)$. In general, this function captures the various inputs into the process of hiring/firing a worker, including: search, recruitment and training costs. It may contain both convex and non-convex forms of adjustment costs.[23]

The cost of adjustment function is:

$$C(e_{-1}, e) = F^{+} + \gamma^{+}(e - e_{-1}) + \frac{\nu}{2}\left(\frac{e - e_{-1}}{e_{-1}}\right)^{2} e_{-1} \tag{4}$$

if there is job creation, $e > e_{-1}$. Similarly

$$C(e_{-1}, e) = F^{-} + \gamma^{-}(e_{-1} - e) + \frac{\nu}{2}\left(\frac{e - e_{-1}}{e_{-1}}\right)^{2} e_{-1} \tag{5}$$

if there is job destruction, $e < e_{-1}$. If $e = e_{-1}$, so there are no net changes in employment, then $C(e_{-1}, e) \equiv 0$.

There are three types of adjustment costs, with differences allowed for the job creation and job destruction margins. The first is the traditional quadratic adjustment cost, parameterized by ν. A fixed cost of adjustment is parameterized by F^{-} and F^{+}. Finally, there are linear adjustment costs. The linear firing cost, γ^{-}, is of particular importance as it captures severance payments. One of the key features of the data is inaction in employment adjustment. The fixed cost and linear costs are each capable of creating inaction.

In addition to the differences in adjustment costs of hiring and firing workers, this study allows a threshold for the non-convex adjustment costs. So, as a leading example, the fixed cost of firing (F^{-}) may apply only if the rate of job destruction exceeds a bound. Through this modification of (5), we are able to capture certain institutional features that may generate nonlinearities in adjustment costs.

Finally, there is the prospect of entry. A new entrant pays a cost κ, denominated in units of labor and multiplied by the base wage, ω_0^p. The entrant then draws a profitability shock and starts operation with the lowest level of employment, denoted e_{-}.[24] The free entry condition is

[22]Source: Chinese Household Finance Survey, `http://www.chfsdata.org/default.aspx?cid=7`.

[23]Hamermesh and Pfann (1996) contains a lengthly discussion of adjustment costs models and their interpretation. As in Cooper, Haltiwanger, and Willis (2007), these costs could emerge from search frictions. The Chinese data is not rich enough to permit estimation of an explicit search model. See Krause and Uhlig (2012) as an example of using a search model to study reforms in Germany.

[24]The employment space has a positive lower bound. An alternative model of entry in which the entrant pays a cost, draws a shock and then can costlessly adjust employment generates very similar general equilibrium implications.

$$E_A V(A, e_-) = \omega_0^p \kappa. \tag{6}$$

The value of entry is sensitive to labor costs, so, as in Hopenhayn and Rogerson (1993), the free entry condition will be used to determine wages.

The combination of the employment choice of the continuing private plants, those that exit and the entrants creates a dynamic for the joint distribution of plant productivity and beginning of period employment. Denote this period t distribution as $H_t^p(A, e_{-1})$. The evolution of the joint distribution will be determined in the simulated solution of the model as will its steady state value.

Throughout, we assume that there are no adjustment costs associated with capital. This is, of course, a simplification that allows us to focus on the labor adjustment and the impact of the policies. Cooper, Gong, and Yan (2015) contains an extensive analysis of the interaction between capital and labor adjustment at these plants and argues that the estimated labor adjustment costs for the private plants are not simply reflecting missing capital adjustment costs.

3.1.2 State Controlled Enterprises

While the public sector in China has shrunk over the past 15 years, its employment share remained around 25%.[25] Thus it is important to include the public sector in our analysis.

Cooper, Gong, and Yan (2015) study a dynamic optimization problem for state controlled enterprises along the lines of (2). That analysis allowed public firms to operate under a soft budget constraint but found no empirical support for that effect. Further, the specification allows adjustment costs to differ by ownership. This is a key point: all parameters including the discount factor, the compensation function and the adjustment costs depend on ownership type. In this way, the idea that state controlled enterprises might, for example, have an incentive to reduce employment variability or face higher adjustment costs was taken into account.

Else, the analysis of the state controlled enterprises parallels that of the privately controlled plants. The estimation again finds parameters to match the moments of the SCE.

3.2 Households

There is a unit measure of agents who supply labor and consume the produced good. The agents have heterogenous outcomes as some are employed and others are not.[26] Further, the amount worked by an agent varies, depending on the productivity of its firm. Finally, some household members work at private plants others at public ones.

Preferences of an individual agent are represented by $u(c - g(h)) - \xi \mathbb{I}(h > 0)$ where c denotes the consumption of the single good and h is hours worked. An employed agent suffers a disutility of $\xi > 0$,

[25] National Bureau of Statistics (NBS) of China, Aggregate Urban Employment by Employment Type, `http://data.stats.gov.cn/easyquery.htm?cn=C01`.

[26] Here employed excludes working in the rural sector of the economy. Thus, as pointed out by a referee, the model does not include migration from rural to manufacturing employment.

where $\mathbb{I}(h > 0)$ indicates that the agent's working hours are positive. Assume $u(\cdot)$ is strictly increasing and strictly concave while $g(\cdot)$ is strictly increasing and strictly convex.

As in Hopenhayn and Rogerson (1993) these individual agents belong to a large household. Through this household, labor market risks are potentially shared and consumption is reallocated between employed and non-participating household members. In the equilibrium we construct, variations in hours worked across members of the household are compensated by firms so that the household acts to redistribute from its employed members to those not participating in the labor market.

The objective function of the household is given by

$$\sum_{i \in emp^s} u(c^i - g(h^i)) + \sum_{j \in emp^p} u(c^j - g(h^j)) + (1 - N^s - N^p)u(c^{np}) - \xi(N^s + N^p) \tag{7}$$

where the superscripts s and p represent the public (state) and private sector, respectively. The first sum is over the agents, indexed by i, who are employed in the public sector: $i \in emp^s$. The second sum is over the agents, indexed by j, who are employed in private sector: $j \in emp^p$. The consumption of agents not participating is given by c^{np}. The fraction of public sector workers is N^s and a fraction N^p of household members work in the private sector.

The budget constraint of the household is given by:

$$\sum_{i \in emp^s} c^i + \sum_{j \in emp^p} c^j + (1 - N^s - N^p)c^{np} = \sum_{i \in emp^s} \omega^s(h^i) + \sum_{j \in emp^p} \omega^p(h^j) + (1 - N^s - N^p)\omega^{np} + \Pi + T \tag{8}$$

where $\omega^k(h)$ is the compensation paid to a worker supplying h hours in sector $k = s, p$. Total consumption is funded from a number of sources. The first is the total earning of employed agents in private plants, including compensation for excessive hours. The second is total earnings from public sector employment. This is supplemented by payments of by $(1 - N^s - N^p)\omega^{np}$, to the household from the government, including severance payments paid by the firm to the government which flow to the members of the household who are not participating.[27] The household owns the private firms and obtains profits of Π. The profits from public firms flow to the government so that T is transfers net of taxes to the private sector from the consolidated public sector.[28]

The household chooses consumption for its members, (c^p, c^s, c^{np}). The optimal consumptions satisfy: $u'(c^{np}) = u'(c^i - g(h^i))$ for all $i \in emp^s$ and $u'(c^{np}) = u'(c^j - g(h^j))$ for all $j \in emp^p$. So $c^i = c^{np} + g(h^i)$ all $i \in emp^s$ and $c^j = c^{np} + g(h^j)$ for all $j \in emp^p$. In this way, workers are exactly compensated for the disutility of working at a particular firm. The levels of consumption of employed and non-participating household members are determined directly from the budget constraint.

Given a compensation function, $\omega^p(h)$, and its redistribution between members, the household also

[27] As emphasized to us by our referees, the model does not distinguish unemployment from non-participation.

[28] Thus the compensation paid to public sector workers cancels from the budget constraint and the net flow to the household from the government equals the total production, net of adjustment costs, of the public sector plants.

chooses the fraction of its members, N^p, who will work in the private sector. The fraction of household members working in the private sector is determined from the first order condition of $\omega_0^p(1-\phi)u'(c^{np}) = \xi$, where $\phi \equiv \omega^{np}/\omega_0^k$ is the fraction of the private sector base wage received by a household member who is not participating.[29] Note that this marginal condition refers solely to private employment: labor supply is not relevant for the public sector employment.

Note that the household does not choose N^s. In the segmented markets setting, public sector jobs dominate so that the labor demand by the state controlled plants determines employment in that sector of the economy.

3.3 Stationary Equilibrium

A stationary equilibrium is a private sector compensation function $\omega^p(h)$, state contingent employment and hours $(e^j(A, e_{-1}), h^j(A, e_{-1}))$ for plants in sector $j = s, p$, a participation rate N^j in sector $j = s, p$, a number of active firms and a joint distribution $H^j(A, e_{-1})$ in sector $j = s, p$, such that, given $\omega^s(h)$, : (i) the free entry condition holds, (ii) the labor market clears, (iii) households and plants act optimally, and (iv) the joint distribution over productivity and plant size is constant over time.

Note the asymmetric treatment of public and private plants. The equilibrium is defined given $\omega^s(h)$,which we treat as a policy tool of the government. There is a free entry condition for private plants but not for the public sector.

To construct an equilibrium, set $\omega^p(h) = \omega_0^p + g(h)$. With this construction, the effects of hours variation on household utility are fully compensated by the firm, leaving private sector workers indifferent with respect to hours supplied.[30] Consequently, as noted above, hours will be unilaterally determined by labor demand of private sector firms.

Since the expected profits of an entrant depends inversely on the base wage, ω_0^p, given an entry cost, the free entry condition determines this base wage. Given the base wage, the equilibrium participation rate comes from finding the N^p such that $\omega_0^p(1-\phi)u'(c^{np}) = \xi$ holds. The dependence of c^{np} on N^p comes from the household budget constraint (8). The number of active firms is determined so that the labor market clears.

4 Estimation

The estimation of parameters for plants and households is a necessary component for the policy analysis. The procedure uses information prior to the introduction of the policies to estimate underlying parameters. This section describes the data, summarizes the estimation approach and presents the estimation results.

[29] With workers compensated for the disutility of work, the marginal gain to working is $\omega_0^p(1-\phi)$.

[30] There are many ways to decentralize these trades. These include *ex post* markets for workers at different levels of hours and an *ex ante* contracting model where the labor contract sets the compensation function and state contingent hours so that worker utility is the same regardless of hours worked. All of these decentralize the planner's allocation of risk and hours across plants.

4.1 Private Plants

The data used in this study and in Cooper, Gong, and Yan (2015) are from Annual Surveys of Industrial Production (1998-2007), conducted by the National Bureau of Statistics (NBS) of China.[31] The panel used here includes all private plants with more than five million Yuan in revenue. Private plants are identified through ownership shares.

4.1.1 Moments

An important element in bringing the model and data together is the presence of growth in China that is, by construction, not present in the model. Assume that the efficiency of labor grows at a constant gross rate per year, g, to capture the growth of human capital and/or labor augmenting technological progress in China.

Table 2: Average Employment and Revenue: 1998-2007 unbalanced panel

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Growth Rate
Employment	213	238	222	222	220	221	196	208	199	192	-0.94%
Revenue	46257	49807	54614	52759	56456	64150	58923	68112	87033	108184	10.45%
Value Added	12300	13640	14596	14288	15208	17048	15329	18280	23350	28815	10.52%

Notes: Revenue and value added are in 1,000 RMB and adjusted to 2005 level.

Table 2 summarizes the changes of average employment, revenue and value added for private plants from 1998 to 2007. The average employment per firm decreased 0.94% per year, although plant's average revenue increased significantly. Both revenue and value added grew at an annual rate of around 10.5%. Therefore, we set g equal to 1.105. Importantly, growth in China was not in terms of larger plants but rather in the number of plants.

The first two rows of Table 3 shows the moments from the 1998-2007 data that we target in the estimation.[32] The moments were selected to capture variations in the data needed to estimate key parameters that in turn, determine the effects of the policies on target variables, such as firm size, aggregate employment and productivity. We discuss the calculation of these moments, keeping in mind the removal of growth effects from the data, to be sure the measurement is consistent with moments produced by a stationary model.

The first moment is the standard deviation of the log of revenue per worker, expressed as:

[31] In contrast to Cooper, Gong, and Yan (2015), the estimation here is for the entire sample rather than the 2005-2007 sub-sample. Despite this difference in sample, the estimates are quite close. See Cooper, Gong, and Yan (2015) for a lengthy discussion of the data and its uses in other studies.

[32] These moments and hence estimates differ from those used in Cooper, Gong, and Yan (2015) for a few reasons. First and foremost, the data moments here are from a longer sample. Second, this model includes an exit choice and thus adds an exit rate moment and a cost of operation to the vector of parameters. Third, the balanced panel was created for this analysis after the data was trimmed, not before. Finally, the moments include median plant size and the base wage is estimated not calibrated.

Table 3: Moments for Private Firms, SCE, Exporters and Non-Exporters

	std(r/e)	sc	JC30	JC1020	JC10	inaction	JD10	JD1020	JD30	xrate	$\hat{\alpha}$	$\hat{\rho}$	$\hat{\sigma}$	EMP	fit/1000
						Private: 1998-2007									
Data	0.944	0.879	0.165	0.090	0.127	0.270	0.124	0.079	0.048	0.076	0.765	0.857	0.841	160.377	na
Model	0.737	0.926	0.093	0.103	0.134	0.320	0.109	0.089	0.035	0.069	0.992	0.637	0.740	161.012	24.544
						Private: 2005-2007									
Data	0.988	0.914	0.158	0.075	0.122	0.349	0.103	0.053	0.058	0.071	0.700	0.867	0.882	156.000	na
Model	0.889	0.965	0.119	0.091	0.052	0.415	0.082	0.071	0.072	0.041	1.132	0.672	0.859	157.526	72.092
						SCE: 2005-2007									
Data	1.185	0.961	0.072	0.069	0.193	0.237	0.267	0.066	0.040	na	0.931	0.920	1.068	243.286	na
Model	1.113	0.993	0.030	0.096	0.211	0.236	0.274	0.039	0.027	na	1.053	0.870	1.064	246.400	1.165
						SCE: 1998-2000									
Data	1.205	0.928	0.054	0.035	0.131	0.390	0.212	0.067	0.062	na	0.986	0.882	1.205	na	na
Model	1.149	0.995	0.034	0.070	0.142	0.433	0.211	0.013	0.030	na	1.000	0.880	1.149	na	2.976
						Exporters: 1998-2007									
Data	0.981	0.921	0.136	0.090	0.142	0.236	0.171	0.090	0.039	0.065	0.884	0.880	0.848	307.904	na
Model	0.623	0.933	0.071	0.123	0.155	0.247	0.144	0.095	0.035	0.057	0.963	0.674	0.635	305.179	7.851
						Non-Exporters: 1998-2007									
Data	1.012	0.895	0.116	0.066	0.111	0.303	0.169	0.091	0.057	0.091	0.685	0.859	0.872	142.340	na
Model	0.790	0.918	0.093	0.102	0.117	0.356	0.108	0.084	0.026	0.078	1.008	0.612	0.788	143.859	22.830

Notes: std(r/e) is the standard deviation of the log of revenue per worker, sc is the serial correlation in log employment, JC30 is a job creation rate in excess of 30%, JC1020 is a job creation rate between 10% and 20% and JC10 is a job creation rate greater than 0.1% and less than 10%. The job destruction (JD) moments are defined symmetrically. The entries are the fractions of observations with these rates of job creation and job destruction. Inaction is labor growth between -0.1% and 0.1%. "xrate" is the average exit rate. The data moments $\hat{\alpha}$, $\hat{\rho}$ and $\hat{\sigma}$ are the OLS estimates of the curvature of the revenue function, the serial correlation of the residual from the regression, and the standard deviation of this residual, respectively. "EMP" is the median employment across plants. The effects of growth have been removed from all moments.

$$\ln\left(\frac{R}{e}\right) = \ln(\tilde{R}) - \ln(e) + t\ln(g) \tag{9}$$

where $\tilde{R}$ is revenue, R, removing growth. The standard deviation of the log of revenue per work, $std(r/e)$, is generated through two steps which remove the effects of growth. First, we calculate the standard deviation of $\ln(R/e)$ each year from 1998 to 2007. Second, we calculate the time series average of these standard deviations. Because $t\ln(g)$ is constant across plants in a given year, the standard deviations calculated in the first step remove the growth effect on revenue per worker. Therefore, the data moment of $std(r/e)$ is consistent with its model counterpart.

Because there is no growth in employment per plant, the moments of employment changes and employment correlations simulated from the model are consistent with data moments. These moments include the inaction rate, job creation and destruction rates (JC10, JD10, JC1020, JD1020, JC30, JD30), and the serial correlation in employment (sc). There is no need to detrend these variables.

The OLS estimate of the curvature of the revenue function, $\hat{\alpha}$, is generated by regressing $\ln(R) - t\ln(g)$ on employment and a constant, where t is 0 for year 1998, 1 for year 1999, etc.[33] So, the effects of growth are removed for the moment $\hat{\alpha}$. The moments $\hat{\rho}$ and $\hat{\sigma}$ characterize the AR(1) process of the residual from the regression. Growth effects have been removed from this residual.

There are a couple of key features of the data which are important in the estimation. The first is inaction: about 27% of the observations entail essentially no net change in the number of workers.[34] The second is the presence of significantly large employment changes. Over 16% of the observations entail job creation in excess of 30% of the workforce and nearly 5% have job destruction in excess of 30% of the plant work force. Yet, about 25% of the observations have non-zero job creation or job destruction rates less than 10% (in absolute value). As discussed further below, these moments are key to the estimation of the parameters of adjustment costs which, in turn, are important for analyzing policy effects.

Included in the moments are the OLS estimates of the curvature of the revenue function as a function of employment as well as estimates of the stochastic process of the profitability shock, $(\hat{\alpha}, \hat{\rho}, \hat{\sigma})$. To be clear, these OLS estimates are not taken to be estimates of the structural parameters for two reasons. First, the OLS procedure, of course, does not control for the response of firm size to profitability shocks, thus biasing the estimate of α upwards. Second, the revenue function in our model depends on hours as well as plant-level employment. Yet, hours are not measured in our data set. This will create additional bias in the estimates. As we shall see, the structural analogues of these parameters are quite different from the OLS estimates, indicative of the bias in the OLS regressions.

The final moment is median plant size. This moment is heavily influenced by the base wage, ω_0^p. The other component of the compensation function, ω_1^p, is set so that hours per week are 40 on average.

[33] This estimation conditions on year, industry, and province as well.
[34] Importantly, we observe only net flows, not gross hires and fires.

4.1.2 Procedure

The estimation procedure finds parameters to match these moments using a Simulated Method of Moments (SMM) approach. The main challenge to the estimation is to match the prominent features of the data shown in Table 3. In particular some form of nonlinear adjustment costs are needed to produce this high level of inaction in employment adjustment. That same type of non-convexity can produce observations in the tails of the distribution. A major difficulty arises in matching the relatively small job destruction and job creation rates since models with non-convex adjustment costs alone will typically not imply these small adjustments.

For the empirical analysis, we adopt an empirically tractable compensation function:

$$e\omega^k(h) = e(\omega_0^k + \omega_1^k h^{\zeta^k}). \tag{10}$$

The estimation uncovers $(\omega_0^k, \omega_1^k, \zeta^k)$ for $k = p, s$. This specification slightly generalizes the model by allowing the disutility of work to be contingent on the sector of employment, i.e. $g^k(h) = \omega_1^k h^{\zeta^k}$.[35]

Our specification of adjustment costs allows for the non-convexity to appear after a threshold of adjustment. This is not common in the literature on dynamic factor demand and has a particular interpretation in the Chinese context. Evidently, firms with large job destruction rates face additional costs of firing. It is precisely the variation in these costs that are part of the impact of the labor reform.

In addition, these moments indicate asymmetry in the distribution of firm-level employment changes. Thus our model allows for asymmetries in adjustment costs.

The parameters estimated by SMM are $\Theta \equiv (\zeta, \nu, F^+, F^-, \gamma^+, \gamma^-, \beta, \Gamma, \alpha, \rho, \sigma, \omega_0^p)$. This approach finds the vector of structural parameters, Θ, to minimize the weighted difference between simulated moments $(M^s(\Theta))$ and actual data moments (M^d):

$$\pounds(\Theta) \equiv (M^d - M^s(\Theta))W(M^d - M^s(\Theta))'. \tag{11}$$

The weighting matrix, W, is calculated by inverting an estimate of the variance/covariance matrix obtained from bootstrapping the data. There are 14 moments used to estimate the 12 parameters. So the model is over-identified.

The estimation method starts by solving the dynamic programming problem in (2) for a given value of Θ. The decision rules are calculated as part of this solution. Shocks to profitability are then drawn in a manner consistent with (ρ, σ) in Θ. Given these shocks and the decision rules at the plant level, a simulated panel data set is created and the simulated moments are calculated.

Of course, there is not a one-to-one mapping from moments to parameters: i.e. generally the simulated moments depend on all the parameters. The Appendix of Cooper, Gong, and Yan (2013) includes a table summarizing the effects of small variations in parameter values on the simulated moments. This provides information on the nature of the identification. These responses underlie the standard errors for

[35] This generalization, allowing the disutility of hours to be dependent on the sector of employment, does not impinge on the risk sharing over hours variations across plants.

the estimated model, presented in Table 4.

The cross sectional distribution of employment adjustment (job destruction and creation) is informative about the various adjustment costs. The serial correlation of employment, sc, is particularly responsive to the quadratic adjustment cost parameter. The standard deviation of the log of revenue per worker, $std(r/e)$, is included to capture the role of employment adjustment relative to (unobserved) adjustments in hours worked. The curvature of the compensation function is identified from the standard deviation of the log of revenue per worker. An increase in ζ^p will lead to a larger variation in employment relative to hours and thus a reduction in this moment. Variations in β influence all the moments, particularly the standard deviation of the log of revenue per worker. When, for example, β is low, the future gains from firm-level employment adjustment are more heavily discounted and so the plant relies more on adjusting hours.

As noted earlier, the estimation includes the curvature of the revenue function, α, as well as the parameters of the stochastic profitability process. While these parameters are directly linked to their counterparts in the OLS reduced-form regression, variations in these parameters also influence other aspects of dynamic labor demand. A decision on inaction in firm-level employment adjustment, for example, depends on the serial correlation of the shock. Likewise, large employment adjustments reflect realizations of relatively large, persistent profitability shocks.

4.1.3 Parameter Estimates

The parameter estimates for the sample of all private plants are given in the first row of Table 4, along with their standard errors. Here the fixed costs of hiring and firing are in terms of average revenue. The moments for this estimated model are those reported in Table 3.

The estimated discount factor of 0.922 is low relative to the discount factor of 0.95 assumed in many macroeconomic models. It is noteworthy that this estimated discount factor is consistent with capital market imperfections associated with private plants in China.[36]

An important parameter is the estimated linear firing costs, $\gamma^- = 0.105$. This is about 35% of annual average compensation paid to a worker.[37] The presence of firing costs is important for explaining the asymmetry in the data between large labor adjustments, i.e. the over 16% frequency of job creation in excess of 30% relative to only 4.8% of job destruction in excess of 30%. The low discount factor implies that hiring and firing costs are distinct.

The moments for the baseline parameters are indicated in Table 3. The estimated model captures the main qualitative features of the data: (i) inaction, (ii) bursts of job creation and destruction and (iii) intermediate levels of job growth. The estimated model creates too little variation in the log of revenue per worker and a bit too much serial correlation of employment. The model produces an inaction rate that is higher than in the data.

[36]See the discussion and references in Song, Storesletten, and Zilibotti (2011) and Cooper, Gong, and Yan (2015).

[37]This is calculated in the simulated data from the ratio of the estimate of γ^- to the mean wage, including compensation for extra hours, received per worker.

Table 4: Parameter Estimates and Policy Experiments

Case	ζ	ν	F^+	F^-	γ^+	γ^-	β	Γ	α	ρ	σ	ω_0[a]	ω_1
							All Private: 1998-2007						
base	1.562	0.515	0.035	0.040	0.032	0.105	0.922	486.333	0.309	0.983	3.485	0.129	2.942e-4
	(0.072)	(0.055)	(0.010)	(0.016)	(0.006)	(0.011)	(0.025)	(55.239)	(0.006)	(0.001)	(0.072)	(0.011)	(8.558e-5)
costly exit[b]	1.593	0.563	0.027	0.035	0.083	0.119	0.925	495.434	0.310	0.982	3.414	0.135	2.478e-4
	(0.074)	(0.022)	(0.004)	(0.029)	(0.007)	(0.005)	(0.003)	(26.641)	(0.011)	(0.001)	(0.103)	(0.002)	(7.547e-5)
fc	1.562	0.515	0.035	**0.048**	0.032	0.105	0.922	486.333	0.309	0.983	3.485	0.129	2.942e-4
sp	1.562	0.515	0.035	0.040	0.032	**0.126**	0.922	486.333	0.309	0.983	3.485	0.129	2.942e-4
cl	1.562	0.515	0.035	0.040	0.032	0.105	**0.95**	486.333	0.309	0.983	3.485	0.129	2.942e-4
cl, sp	1.562	0.515	0.035	0.040	0.032	**0.126**	**0.95**	486.333	0.309	0.983	3.485	0.129	2.942e-4
ss	1.562	0.515	0.035	0.040	0.032	0.105	0.922	486.333	0.309	0.983	3.485	**0.155**	2.942e-4
he	1.562	0.515	0.035	0.040	0.032	0.105	0.922	486.333	0.309	0.983	3.485	0.129	**3.530e-4**
							SCE						
2005-2007	1.246	1.823	0.007	0.080	0.013	0.178	0.978	na	0.679	0.986	1.672	0.150	7.195e-3
	(0.072)	(0.872)	(0.007)	(0.034)	(0.008)	(0.041)	(0.063)	na	(0.003)	(0.002)	(0.032)	(0.0243)	(5.376e-4)
1998-2000	1.324	1.334	0.007	0.119	0.157	0.352	0.986	na	0.670	0.984	1.732	0.149	4.661e-3
	(0.034)	(0.295)	(0.023)	(0.035)	(0.057)	(0.205)	(0.013)	na	(0.017)	(0.001)	(0.046)	(0.075)	(4.853e-4)

Notes: Here: (i) "base" are the baseline estimates, with standard errors in parentheses, (ii) "fc" is a 20% increase of the fixed cost, (iii) "sp" increases severance pay by 20%, (iv) "cl" is credit market liberalization, (v) "cl, sp" combines an increase in severance pay with credit market liberalization, (vi) "ss" is a 20% increase of social security contributions, (vii) "he" is a 20% increase of the component of hours compensation, ω_1. An additional experiment, "fc(10)", is discussed in the text. The policy changes are **bold**.

[a] In partial equilibrium, the base wage ω_0 is held fixed under different policies. In the general equilibrium analysis, the base wage adjusts to satisfy the free entry condition.

[b] "costly exit" refers to the alternative model setting in which a firm is required to pay workers severance payment upon exit.

As noted earlier, one of the challenges for models of adjustment costs is to capture the intermediate adjustments along with the inaction and bursts of job creation and destruction. The model does match the intermediate levels of job destruction because the fixed cost of firing applies for job destruction in excess of 20%. The inaction is a consequence of the linear hiring and firing costs creating a lack of differentiability at zero adjustment.

One of the interesting features of the estimation results is that the asymmetric adjustment costs are able to reproduce the more symmetric distribution of job creation and destruction rates. That is, though our findings indicate the significance of firing costs, the model is still capable of matching the moments of job creation. This is partly due to the fact that hiring decisions are influenced by the prospects of firing and thus the costs associated with job destruction.

The model we estimate includes exit, at an average annual rate of 6.9%. The exit is induced, in part, by the overhead cost, Γ, but is also influenced by the discount factor, β. The exit rate is matched using an unbalanced panel. Following the procedures used in the creation of the data moments, a balanced panel is selected from the simulated unbalanced panel to match the moments in Table 3.

Though the simulated moments in Table 3 appear close to the data, the difference is statistically significant. That is, the value from (11) is 24.544×10^3 so that the hypothesis that $\pounds(\Theta) = 0$ is soundly rejected. Given the large number of plant year observations, the moments are tightly estimated and thus the elements of the weighting matrix W are very big. Thus the $\pounds(\Theta)$ is large though the estimated model succeeds in matching key aspects of the data.

4.2 State Controlled Enterprises

The SCE parameter estimates are obtained from the same methodology as those for the private sector plants. The moments matched are given in Table 3 and the parameter estimates are given in Table 4. The moments and hence estimates come from two different sample periods since these estimates are used for two different purposes in the analysis.

The 2005-2007 sample of state controlled enterprises builds upon that described in Cooper, Gong, and Yan (2015).[38] This sample represents the state controlled enterprises after the period of privatization.

As discussed in Cooper, Gong, and Yan (2015), there are a number of important differences between private and state controlled plants. Relative to private plants from the 2005-2007 period, from Table 3, the SCE have considerably less inaction in employment adjustment and also have lower levels of job creation of 30% or more. Instead, the SCE have more intermediate level changes in employment. From Table 4, these differences in moments translate into a number of important differences in parameter estimates. First and foremost, SCE discount the future much less than private enterprises. Second, the quadratic adjustment costs are larger for the SCE as are the linear firing costs.

[38] These estimates are slightly different from those reported in Table 8 of Section 6 of Cooper, Gong, and Yan (2015) as in this exercise we are matching plant size as an additional moment. The inclusion of this additional moment is important for our exercise of assessing the impact of policies on privatization. Further, these estimates are only for state-controlled enterprises. Finally, there is no entry and exit of public plants in the model so that Γ is not estimated.

The second sample studied is from 1998-2000, also building upon Table A3 in Cooper, Gong, and Yan (2015). This sample period is chosen as the estimates will provide a basis for analyzing privatization occurring after 1998.

4.3 Other Parameters

Importantly, there are other parameters determined in equilibrium and not estimated from the plant level optimization problem. These are household preferences and the cost of entry in the private sector. A novel feature of our approach is to use equilibrium conditions to infer these other parameters once the parameters for the plant level dynamic optimization are estimated in the first stage.

First, the expected value to an entrant is determined in the solution of the private plant dynamic optimization problem as $E_A V(A, e_-)$ where e_- is the minimal level of employment and thus the level employment for an entrant. The cost of entry, κ, is determined by this expected value of entry for private plants.[39]

Second, the disutility of employment ξ, is inferred from the household participation decision condition: $\omega_0^p(1-\phi)u'(c^{np}) = \xi$. In equilibrium, the household level of consumption c^{np}, is determined by (8).[40] In China, the subsistence payments through the welfare system amount to about 30% of the base wage.[41] Thus we set $\phi = 0.30$. Further, we assume log utility. With these inputs and estimated structural parameters, we calculate $\xi = 0.148$ with the baseline parameters.

5 Private Sector Policy Implications

We use the estimated model to study the effects of recent job protection measures on **private sector plants**. Throughout this exercise, the actions of the SCE are taken as given. This reflects the fact that these policies were intended to regulate private plants. Further, by holding fixed the compensation at the SCE, we isolate the effects of the measures on private plants. The empirical analysis in sub-section 6.2 explores the differential effects of the policies.

It is not possible to accurately incorporate all elements of the policy measures into our analysis. Instead, we use the policy measures as motivation for changes in various parameters. The results are indicative of the direction and magnitude of responses to these policy actions. Further, for this analysis we assume compliance with the policies so that our results are an upper bound on the effects of these interventions.

Doing so requires us to solve for the general equilibrium of the model for given policies. As in Hopenhayn and Rogerson (1993) this reduces to two conditions: (i) free entry and (ii) labor market clearing. Policy

[39] This approach follows Hopenhayn and Rogerson (1993).

[40] To determine c^{np}, we set the participation rate at 75.10% to match the mean of labor participation rates (% of total population ages 15+) in China of 75.30 as of 2005, 75.10 as of 2006, and 74.90 as of 2007. These participation rate comes from the Mundi Index: `http://www.indexmundi.com/facts/china/labor-participation-rate`. About 25% of workers are employed in the state sector. For the policy experiments, the participation rate adjusts for fixed ξ and is determined by (8).

[41] The average ratio of subsistence payments to base wage is based on Chinese annual provincial data from 2000 to 2007. See, `http://wenku.baidu.com/link?url=3IVQlFSglB6_YMxXxiqysANt1p1shaax86vze3va-CDSvUOhh4zQCYOC5ABQVLz7aINir8bGraExW3MwBQZTi0pPZ74OjrsdmgBoeuHiu93`.

interventions will influence the private sector base wage through their effects on the value of entry so that the free entry condition holds given the estimated value of κ. At the estimated Θ, the elasticity of the value of entry with respect to the base wage is about -0.72: so there is sufficient sensitivity of this value to determine the base wage in equilibrium.

The response of the base wage to interventions also reflects the effect of the policies on the value of participating to ensure labor market clearing given the estimated disutility of employment, ξ. The effect of the labor market policies on the participation rate comes from the household budget constraint, (8), and the household labor supply condition, $\omega_0^p(1-\phi)u'(c^{np}) = \xi$. The policy interventions will impact c^{np} directly through net revenue and also through variations in ω_0^p.

5.1 Policies

This section lays out the mapping from the Chinese policies presented in section 2 to changes in parameter values. These changes are summarized by the various rows of Table 4.

There are two experiments associated with changes in the fixed firing cost. One interpretation of this parameter is that it reflects administrative and political costs of large job destruction. One policy experiment, labeled "fc", increases this fixed cost by 20%. A second, labeled "fc(10)" assumes that this fixed cost applied for job destruction above 10% rather than the 20% found in the estimation. As noted earlier, labor disputes have risen sharply under the new law, leading to increased costs of firing workers.

The policy measures include the extension and enforcement of severance pay provisions. We model this as a 20% increase in the linear firing costs. As noted earlier, the estimated linear firing cost could be interpreted as severance payment of about 4 months of average annual wages. This experiment, labeled "sp" amounts to an increase in severance pay to cover an additional 3 weeks of average wages. The main effect is on employment through the increased firing costs of a firm. As explained further below, the household participation rate responds as well.

The estimated discount factor is considerably lower than the commonly parameterized value of β in dynamic general equilibrium models. One interpretation, discussed in more detail in Cooper, Gong, and Yan (2015), is that the estimated discount factor reflects capital market imperfections. The treatment labeled "cl" increases the discount factor to 0.95. This partly reflects the ongoing discussion in China, noted by former Finance Minister Lou and the measures noted earlier, about opening access to credit markets.

It is of interest to combine the experiments of increasing severance pay with capital market liberalization. Further, as we shall see, the effects of the policy depend on the firm's discount factor. This experiment is labeled "cl,sp". Here the discount factor is set at 0.95 and the linear firing costs increase by 20%.

There is an experiment associated with a 20% increase in social security payments modeled as an increase in the base wage, ω_0^p. This case is labeled "ss". This experiment captures the increased social security contributions and the principle of equal pay for equal work by Article 11. Under the new law, the employer is required to contribute to the social benefits of workers on contracts.

In our model, the government receives these social security transfers from the firm. In equilibrium, these policies can influence the base wage and thus the participation decision of the household.

The enforcement of overtime provisions means that hours variation is more costly. The treatment labeled "he" increases the component of compensation associated with hours, ω_1^p, by 20%.

5.2 Employment and Productivity Effects

Table 5 summarizes the implications of the policies on plant size and productivity in the private sector. The policies are listed as rows. The first two columns report medium employment level, averaging across time.[42] Under the heading "part." are partial equilibrium results in which the base wage is held fixed and there is no entry nor exit. The impact of endogenous wages as well as entry and exit is brought out in the general equilibrium analysis, labeled "gen.".

5.2.1 Labor Demand Shifts

The partial equilibrium exercise is useful for understanding the direct effect of the policies on labor demand in the private sector.[43] Relative to the baseline, there are relatively large employment effects for variations in severance pay, credit liberalization, increases in the social security payments and the cost of varying hours. The other policy interventions, particularly the changes in the fixed cost of firing, do relatively little to labor demand.

In partial equilibrium, an increase in severance pay, the "sp" experiment leads to a 9.8% increase in firm size. An increase in linear firing cost is naturally going to have two effects. One is to reduce job destruction since it is more expensive to fire workers. But, this increased cost of firing means that firms are reluctant to hire workers. Which effect dominates is not clear.

In our model, we can trace this firm size enhancing effect of an increase in linear firing costs to the high discount rate of private plants. From simulated data, when the firing cost is increased, plants experiencing relative low profitability realizations do not fire workers while those with relatively high profitability expand. The overall effect is an expansion of firm size. This asymmetric response is driven by the low discount factor so that job creation responds to the current shock and the future prospects of costly job destruction are given less weight.

This point drives the effects on firm size of credit liberalization, the "cl" experiment. When the discount factor rises to 0.95, firm size falls since plants incorporate into hiring decisions a higher present value of firing costs.

The "cl, sp" experiment combines the "sp" treatment with a particular value of the discount factor. The idea was to illustrate the combined effect of these interventions, as in recent Chinese policy. An increase of β from the baseline value to 0.95 is large enough to offset the firm size enhancement of the increased severance pay. For the 20% increase in severance pay, at $\beta = 0.95$, firm size decreases rather than

[42] We are looking at the moments produced from a stationary allocation in which entry and exit rates balance, given the base wage. These moments are calculated for the balanced panel.

[43] Cooper, Gong, and Yan (2013) provides more details and additional exercises.

Table 5: Policy Experiments: Private Firm Size and Productivity

	Firm Size		Productivity					
Policy	part.	gen.	reall.	$E(p_t)$	$c(A_{it}, s_{it})$	$E(\hat{p}_t)$	$c(apl_{it}, s_{it})$	$E(\sigma(log(apl_{it})))$
base	161.012	161.012	0.122	17.992	6.641	1.322	0.229	0.770
no ac	99.124	41.135	0.488	23.697	18.590	2.476	0.000	0.000
fc	161.391	161.392	0.122	17.977	6.627	1.321	0.228	0.771
sp	176.761	176.845	0.112	17.704	5.792	1.296	0.238	0.799
cl	106.666	110.018	0.145	18.506	7.717	1.622	0.307	0.730
fc(10)	159.503	159.895	0.122	17.973	6.595	1.320	0.228	0.773
cl, sp	109.270	113.312	0.138	18.332	7.505	1.614	0.317	0.742
ss	149.120	161.012	0.122	17.992	6.641	1.322	0.229	0.770
he	165.000	163.962	0.118	17.798	6.470	1.258	0.229	0.783

Notes: 1. "Firm size" is the median establishment size for the partial (part.) and general (gen.) equilibrium models. For productivity, "reall." is the mean level of reallocation, defined as the sum of job creation and job destruction rates. $E(p_t) \equiv E(A_{it} \times shr_{it})$ is the time-series average of the product of the profitability shock and the establishment employment share, $c(A_{it}, shr_{it})$ is the time-series average covariance between the profitability shock and the employment share. $E(\hat{p}_t) \equiv E(apl_{it} \times shr_{it})$ is the time-series average of the product of the average revenue product of labor and the establishment employment share,, $c(apl_{it}, s_{it})$ is the time-series average covariance of employment share and the average revenue product of labor at the establishment, $E(\sigma(log(apl_{it})))$ is the time-series average standard deviation of the average log revenue product of labor.

2. The policy experiments include: (i) "base" are the baseline estimates; (ii) "no ac" is frictionless or no labor adjustment cost; (iii) "fc" is a 20% increase of the fixed cost, (iv) "sp" increases severance pay by 20%; (v) "cl" is credit market liberalization; (vi) "cl, sp" combines an increase in severance pay with credit market liberalization; (vii) "fc(10)" is an experiment that the fixed firing cost applied for job destruction above 10% rather than the 20% found in the estimation; (viii)"ss" is a 20% increase of social security contributions; (xi) "he" is a 20% increase of the component of hours compensation, ω_1^p.

increases compared to the "sp" experiment alone. Note that this decrease is still less than the reduction in median firm size under the "cl" experiment alone. So even at $\beta = 0.95$, the marginal effect of an increase in severance pay is to increase employment, though much less at this higher level of the discount factor.

Sizable employment effects arise from variations in required social security payments by employers that are equivalent to policy induced variations in the base wage, the "ss" experiment. The 20% increase in the social security payments is associated with an employment reduction of nearly 8%: the elasticity of labor demand is about -0.4.

As with the employment effects of overtime provision, the "he" experiment, which increases the cost of hours variation, increases firm size. Essentially, this experiment creates an incentive for firm to switch, on the margin, from changing hours worked to changing the number of workers in response to a profitability shock.

5.2.2 General Equilibrium Response

Comparing the partial and general equilibrium employment effects in Table 5, there are a couple of key differences brought about by the adjustment of wages. The magnitude of the equilibrium wage adjustments are shown in the first column of Table 6. Recall that the base wage influences the cost of workers directly but also impacts both the overhead and entry costs.

The "sp" experiment leads to an increase in firm size in the general equilibrium model as it did in the partial equilibrium model. As seen in Table 6, increasing severance pay has a small effect on the base wage.

In contrast, the adverse effect of the "cl" experiment on firm size is smaller in the general equilibrium model. From Table 6, this is due to the higher wages created by the increase in the firm discount factor β from 0.922 to 0.95.

For the "ss" experiment, the increase in the mandated social security payment is offset in the general equilibrium model leading to no change in the base wage. Consequently, there are no employment effects relative to the baseline. If the authorities act to prevent adjustments in wages in response the policy, then the partial equilibrium results may be a better guide to the effects of the increase in these payments.

Finally, the reduced base wage in the "he" experiment leads to an increase in firm size that actually exceeds the baseline. Here the general equilibrium response partially offsets the partial equilibrium effects.

The remaining columns of Table 6 summarize other policy effects on the **private sector**. The participation rate indicates the labor supply of the household or aggregate employment. The exit margin is indicated by the fraction of plants exiting, "xrate", and the consequent job destruction, "JD exit". The level of output is shown as net revenue per capita, i.e., revenue excluding fixed and quadratic adjustment costs, entry cost and operation cost. The number of firms, "firm #", is the ratio between aggregate labor supply in the private sector and average employment of each private firm. An increase of this number indicates a larger growth of aggregate labor supply than that of firm size.

Of these experiments, credit liberalization has a large influence on these other aspects of the equilibrium outcome. The increase in the discount factor (lower interest rate) increases the discounted present value of participating. To offset this, the base wage rises. In equilibrium, the number of firms increases by 81%

Table 6: Private Sector General Equilibrium Effects: Alternative Policies

Policy	w_0	$\bar{w}(h)$	N^p	xrate	JD exit	output	firm #
base	0.1290	0.3603	0.5633	0.0691	0.0204	0.5113	100,000
fc	0.1290	0.3602	0.5637	0.0691	0.0205	0.5112	99,978
sp	0.1289	0.3532	0.4704	0.0648	0.0189	0.4345	78,241
cl	0.1554	0.4304	0.7674	0.0625	0.0149	0.7286	181,238
fc(10)	0.1290	0.3600	0.5633	0.0692	0.0207	0.5110	99,587
cl, sp	0.1553	0.4281	0.5552	0.0630	0.0159	0.5274	130,358
ss	0.1290	0.3603	0.5633	0.0691	0.0204	0.5113	100,000
he	0.1230	0.3412	0.5464	0.0689	0.0207	0.4729	96,951

Notes: 1. Here, $\bar{w}(h)$ is the average compensation paid to a worker across private firms; "N^p" is the participation rate in the private sector; exit rate, "xrate", is the fraction of private plants exiting and "JD exit" is the job destruction rate from exit; "output" is net revenue per capita, i.e., revenue excluding fixed and quadratic adjustment costs, entry cost and operation cost.; "firm #" is the number of private firms, which is normalized to 100,000 in the baseline case.

2. The policy experiments in the private sector include: (i) "base" are the baseline estimates, (ii) "fc" is a 20% increase of the fixed cost, (iii) "sp" increases severance pay by 20%, (iv) "cl" is credit market liberalization, (v) "cl, sp" combines an increase in severance pay with credit market liberalization, (vi) "fc(10)" is an experiment that the fixed firing cost applied for job destruction above 10% rather than the 20% found in the estimation, (vii)"ss" is a 20% increase of social security contributions, (viii) "he" is a 20% increase of the component of hours compensation, ω_1.

which combines a 36% increase in labor supply and a 32% reduction in firm size. Average output (and consumption) and the participation rate is higher to maintain the household first-order condition for N^p. Note too that for this experiment, the exit rate and job destruction rates from exit are lower as firms are more forward looking.

The participation rate is noticeably lower in the "sp" experiment. In this experiment, the increased severance pay is treated as a transfer from firms to the government. The additional revenues could either be used to supplement the payments to non-participants or to reduce the lump sum tax on households. For the results presented here, the transfer to non-participants, denoted ϕ in the household first-order condition, increases by 20%. This creates a disincentive to work so that, relative to the baseline, the participation rate is lower.

Relative to the baseline, the reduction of the number of firms is largest in the "sp" experiment. In contrast the "cl" experiment increases the participation of workers as well as the number of firms.

There are no risk sharing gains from these interventions. As noted earlier, the labor market outcome shields workers from risk over hours and the household redistributes across its members. Thus the analysis highlights the costs of the intervention from frictions in reallocation. Given the attention to output and productivity by policymakers in China, the focus on the output effects of the interventions is not misplaced.

5.3 Productivity Effects

Hsieh and Klenow (2009), Song, Storesletten, and Zilibotti (2011) and Deng, Haltiwanger, McGuckin, Xu, Liu, and Liu (2007) have chronicled the importance of reallocation for productivity in China. Those studies focus on the period of transformation during the 1990s and the 2000s. Deng, Haltiwanger, McGuckin, Xu, Liu, and Liu (2007) calculate counter-factuals using their decomposition of productivity growth to highlight the contribution of reallocation. Our analysis replaces those counter-factuals with simulations of the impact of the interventions on frictions and thus reallocation.[44]

The policy interventions impact productivity, in principle, in two ways. First, the policies may introduce barriers to labor mobility. This additional friction in the reallocation process can have aggregate productivity implications. Second, these policies may influence the continuation decisions of plants.

The second panel in Table 5 summarizes the effects of the policy interventions on job flows and measures of productivity. The column labeled "reall." reports job reallocation rates for the simulated data. The flows are calculated from the simulated data using the same definitions as in, for example, Foster, Haltiwanger, and Kim (2006). The rates are thus weighted by plant size. As there are no aggregate shocks, the average job creation and destruction rates are equal to one-half of the reallocation rate.

Returning to the questions posed in the introduction, this analysis provides insights into the productivity effects of the interventions. We study a couple of measures of the misallocation of labor on productivity. For this discussion, it is useful to think of a large economy producing a single product with differences in productivity across private plants. In this way, the reallocation is linked to total output of the private sector rather than its composition.[45]

Let $s_{it} \equiv \frac{e_{it}}{\sum_j e_{jt}}$ be the share of employment in the private sector and p_{it} productivity at private establishment i in period t. Then the average weighted productivity in period t is given by $p_t \equiv E(p_{it} \times s_{it})$. As in Olley and Pakes (1996), interpret p_t as aggregate productivity and decompose it as:

$$p_t = \bar{p}_t + cov(p_{it}, s_{it}) \tag{12}$$

where $\bar{p}_t$ is the unweighted mean of p_{it}. For our analysis, $\bar{p}_t$ is not constant due to the effects of entry and exit on the distribution of productivity.

One measure of plant level productivity is the shock to profitability, i.e. $p_{it} = A_{it}$. For this measure, the average weighted profitability shock, $E(p_t)$, as well as the covariance of the time-series average of the employment share and the profitability shock, $cov(A_{it}, s_{it})$ are shown in the first two columns under "Productivity" in Table 5. The mean of weighted profitability as well as the covariance are highest in the frictionless ("no ac") case. Both of these terms are lower when frictions are present, indicating the misallocation of labor across establishments. Relative to the baseline, productivity losses are largest in the "sp" experiment alone. **The loss in productivity due to the increased severance pay is about 2%**.

As a basis of comparison, according to our estimates, eliminating existing labor market frictions (i.e. comparing the baseline and no adjustment costs cases) in China would increase productivity by about 32%. This is at the lower end of the interval reported by Hsieh and Klenow (2009) in their characterization of

[44] These calculations are from the general equilibrium model with an unbalanced panel, thus allowing exit.

[45] This interpretation is also adopted in Hopenhayn and Rogerson (1993).

the productivity gains to China from reducing frictions to the US level.

A comparable statistic can be computed using the average revenue product of labor (apl) as a measure of productivity, i.e. $p_{it} = apl_{it}$. As in Deng, Haltiwanger, McGuckin, Xu, Liu, and Liu (2007) this is a more direct measure of productivity to calculate. In this case, the covariance is informative about the share of employment at relatively high average productivity plants. In a frictionless environment, the marginal productivity of labor, as well as the average productivity given our model, is equal across production sites. This is seen by the "no ac" row in Table 5. But frictions in labor adjustment change the cross-sectional distribution of employment and hence the covariance of employment share and labor productivity.

The other rows, including the baseline, do not have a zero standard deviation of $\log(arpl_{it})$ nor zero covariances. These are all indicative of productivity gains to reallocation, reflecting the frictions to labor reallocation. These frictions are significantly higher in the "sp" case. Note too that the covariance between the shock and the average revenue product of labor is positive indicating that the most profitable plants have higher than average marginal revenue products of labor. Thus, on efficiency grounds, labor should be reallocated to the more profitable plants.

For the "sp" and "he" experiments, which have large employment effects, reallocation is substantially lower, as is mean (weighted) productivity. For these two policy experiments, the covariance between productivity and employment share is lower. The "he" experiment reduces the covariance between firm size and productivity substantially. For these cases, the reduction in the covariance between plant size and productivity implies lower average productivity and hence lower output. And again the "cl" experiment increases employment weighted productivity.

5.4 Dynamics

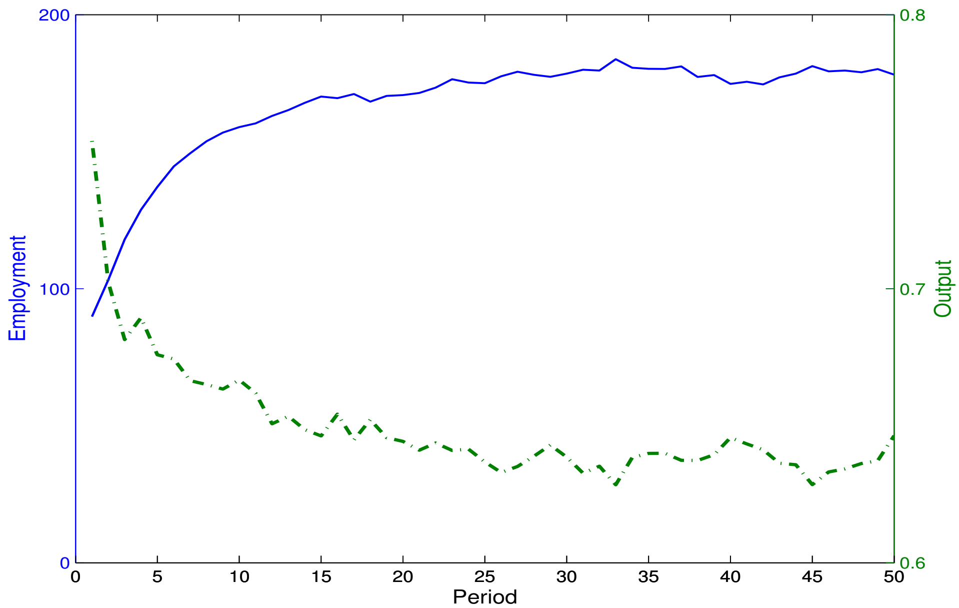
The analysis thus far compares the long-term averages of two regimes. The first is created by the baseline parameter estimates. The second comes from these parameters augmented by the various policy interventions. The results on private sector firm size, productivity and so forth provide guidance as to the long-run impact of these policies.

There are transitional effects that arise when the policy is first implemented. Since the increase in severance pay has the large and counterintuitive effects, we focus on the transitional dynamics associated with that policy. To do so, we simulate a panel data set under the baseline parameters. The policy change then occurs, unexpectedly. The policy change is assumed to remain in force.[46]

We trace out the path of median firm size and output per capita in the private sector for 50 periods in Figure 1. In contrast to the moments presented in Table 5, the employment size is not for a balanced panel. Instead, employment in Figure 1 is the median size of firms that might subsequently exit. Hence employment is lower in this figure compared to that in Table 5. Wages are held fixed at their baseline since, as shown in Table 6, the base wage does not change across steady states under the "sp" intervention

[46]Of course one could introduce the policy change itself into the model using a two-state Markov process. The experiment we study is one where the two states are permanent which, by continuity, will be close to the responses when the transitions between states are close to zero.

Figure 1: Private Sector Employment and Output Transitional Dynamics: Severance Pay Increase



The series come from the "sp" experiment. The policy is introduced permanently in period 0. The figure displays median employment per firm (solid) and output per capita (dashed) during the transition to the new steady state.

and so is unlikely to change much in the transition.

In the initial period, the policy is not in force and the median level of employment is about 90 workers. Median employment is closer to 180 by the end of the simulation period for the "sp" experiment.

The response to the policy in the first fifteen periods is striking. Employment grows rapidly. At the estimated discount factor, plants with positive profitability shocks respond more to the current positive gains of adding workers, discounting the higher future firing costs. Yet those plants with relatively low profitability do not fire due to the higher severance payments. Thus employment increases rapidly when the policy is first introduced.

Output per capita shows a different growth pattern than firm size. If there was no firm exit, the rapid increase in employment would result in an increase in output per capita. The dramatic drop of output following the increase of firm size in the first fifteen periods is the consequence of a high exit rate of firms during that period. Over the first five periods exit rates start at over 9% and decline to 7%.

5.5 Robustness

This sub-section briefly explores the robustness of our findings regarding the impact of severance pay and credit market liberalization.

Table 7: Parameters Estimates: Comparing Samples

ζ	ν	F^+	F^-	γ^+	γ^-	β	Γ	α	ρ	σ	ω_0^p	ω_1^p
							Private: 1998-2007					
1.562	0.515	0.035	0.040	0.032	0.105	0.922	486.333	0.309	0.983	3.485	0.129	2.942e-4
(0.072)	(0.055)	(0.010)	(0.016)	(0.006)	(0.011)	(0.025)	(55.239)	(0.006)	(0.001)	(0.072)	(0.011)	(8.558e-5)
							Private: 2005-2007					
1.112	0.408	0.055	0.003	0.033	0.126	0.923	448.982	0.452	0.989	3.584	0.134	0.015
(0.005)	(0.075)	(0.006)	(0.143)	(0.006)	(0.033)	(0.095)	(164.470)	(0.077)	(0.004)	(1.365)	(0.008)	(0.006)

This table provides estimates for private plants from the 2005-2007 period compared to the longer sample from 1998-2007 used for the baseline estimates.

5.5.1 Growth

As explained earlier, the calculation of the moments removed growth effects. During the 1998-2007 period, there were numerous changes in market structure and organization in China that might not be neatly captured through the removal of a constant growth factor.

To study the robustness of our findings, we present estimates of the model and policy analysis focusing on the 2005-2007 period alone. The parameter estimates from 2005-2007 are shown in Table 7.[47]

Compared to the estimates using the 1998-2007 sample, the short sample has a lower cost of adjusting hours, a lower fixed firing cost and a higher linear firing cost. The estimated value of the discount factor is essentially the same. The curvature of the revenue function is larger in the short sample.

The policy results are shown in Table 8 for the two key experiments. As with the baseline estimates, the introduction of severance pay leads to an expansion in median plant size and a drop in productivity. And, as before, the credit liberalization leads to a reduction in employment at the median plant and an expansion of productivity.

5.5.2 The Effects of Severance Pay

In the analysis of the effects of severance pay, a couple of potentially critical assumptions were made. Here we study the robustness of our findings relative to alternative specifications which are both closer to the structure in Hopenhayn and Rogerson (1993).

First, variations in severance pay were reflected in ϕ and thus directly impacted the household participation decision, $\omega_0^p(1-\phi)u'(c^{np}) = \xi$. The natural interpretation is that an increase in severance payment reduces the gap between the compensation of employed and non-participating households.

If, instead the firm's payments of severance pay was paid to the government but not relayed to the workers, then ϕ would not adjust and the direct effect on participation would be negated. This case is

[47]The estimates for 2005-2007 differ from those reported in Cooper, Gong, and Yan (2015) as in that estimation ω_0^p was calibrated and median size was not a moment matched.

Table 8: Private Sector Policy Experiments:
Comparing 1998-2007 and 2005-2007

	Firm Size		Productivity					
Policy	part.	gen.	reall.	$E(p_t)$	$c(A_{it}, s_{it})$	$E(\hat{p}_t)$	$c(apl_{it}, s_{it})$	$E(\sigma(log(apl_{it})))$
				Private: 1998-2007				
base	161.012	161.012	0.122	17.992	6.641	1.322	0.229	0.770
sp	176.761	176.845	0.112	17.704	5.792	1.296	0.238	0.799
cl	106.666	110.018	0.145	18.506	7.717	1.622	0.307	0.730
				Private: 2005-2007				
base	157.526	157.526	0.143	22.378	12.282	3.438	0.837	0.916
sp	177.383	177.393	0.135	22.077	11.791	3.356	0.932	0.951
cl	145.250	115.981	0.160	22.991	13.112	4.027	0.803	0.876

This table provides the effects of “sp” and “cl” policies on plant size and productivity for private plants from the 2005-2007 period compared to the longer sample from 1998-2007.

studied in the row labeled “sp($\Delta\phi = 0$)” in Tables 9 and 10. Relative to the case of an increase in severance pay that also increases ϕ, denoted “sp”, the employment and productivity effects, reflecting labor demand, are exactly the same. This is because the base wage is independent of the flow from the government to the workers. That flow, however, does influence the participation decision of workers as seen in Table 10. Without the additional subsidy for non-participations, the participation rate does not fall as much when severance pay is increased.

Second, we assumed that an exiting firm can avoid making severance payments to workers. Instead, one might imagine that a firm would be unable to exit without compensating workers, as in Hopenhayn and Rogerson (1993). The model was re-estimated with this change in the value of exit so that linear firing costs were paid upon exit. The parameter estimates appear in row “costly exit” of Table 4. The

Table 9: Policy Experiments: Alternative Treatments of Severance Pay

	Firm Size		Productivity					
Policy	part.	gen.	reall.	$E(p_t)$	$c(A_{it}, s_{it})$	$E(\hat{p}_t)$	$c(apl_{it}, s_{it})$	$E(\sigma(log(apl_{it})))$
base	161.012	161.012	0.122	17.992	6.641	1.322	0.229	0.770
sp	176.761	176.845	0.112	17.704	5.792	1.296	0.238	0.799
sp($\Delta\phi = 0$)	176.761	176.845	0.112	17.704	5.792	1.296	0.238	0.799
					Costly exit			
base	164.568	164.568	0.114	16.925	5.514	1.410	0.154	0.770
sp	165.347	165.464	0.109	16.792	5.381	1.409	0.149	0.781

This table provides the effects of “sp” policy on plant size and productivity in alternative models where welfare payments to non-participants do not adjust with the increase of severance payments, denoted as “sp($\Delta\phi = 0$)”, and severance payment is paid upon exit, denoted as “Costly exit”.

Table 10: General Equilibrium Effects in the Private Sector: Alternative Treatments of Severance Pay

Policy	w_0	$\bar{w}(h)$	N^p	xrate	JD exit	output	firm #
base	0.1290	0.3603	0.5633	0.0691	0.0204	0.5113	100,000
sp	0.1289	0.3532	0.4707	0.0648	0.0189	0.4345	78,241
sp($\Delta\phi = 0$)	0.1289	0.3532	0.4990	0.0648	0.0189	0.4609	83,003
				Costly exit			
base	0.1347	0.3929	0.5633	0.0702	0.0202	0.5418	100,000
sp	0.1346	0.3938	0.4855	0.0702	0.0225	0.4679	86,302

This table provides the general equilibrium effects of "sp" policy in alternative models where welfare payments to non-participants do not adjust with the increase of severance payments, denoted as "sp($\Delta\phi = 0$)", and severance payment is paid upon exit, denoted as "Costly exit".

parameter estimates are close to the baseline though the fixed cost of operation is higher, to compensate for the increased cost of exit and match the exit rate.

The block labeled "costly exit" in Tables 9 and 10 studies the "sp" experiment in the model where severance pay is paid upon exit, in addition to the baseline linear firing cost. The household is directly impacted by the increase in severance pay, as in the baseline. For this experiment, firm size increases with the severance payment but not as much as in the baseline case. Further, the increase in severance pay leads to a fall in reallocation and in productivity. On the household side, the increase in severance pay again leads to a fall in the participation rate and through labor market equilibrium a reduction in the number of firms.

6 State Controlled Plants: Privatization and Policy Effects

In this section we study two effects of the policy intervention, highlighting differences between public and private plants. The analysis is informed by the estimates of the state controlled plants.

First, we study how the privatization would have proceeded **if** the job protection measures had been in force in 1998. As stressed in numerous studies, privatization is certainly a big part of the recent growth in China.[48] Using a decomposition of growth rates, Deng, Haltiwanger, McGuckin, Xu, Liu, and Liu (2007) study the between and within components of productivity growth (measured as average labor productivity) in China for the 1995-2003 period. They emphasize the significance of the shedding of workers by state owned enterprises for productivity growth.

Second, we study the impact of the policy by comparing responses of private and publicly controlled plants after the policy using actual data. This enables us to isolate the effects of the new labor law on employment in 2008 as the public plants are treated as a controlled group and the private plants are the one "treated" by the policy intervention. We also compare foreign and domestic plants as the former discount much less than the latter. This provides insights in to the effects of the discount factor on the response to the policy interventions.

[48]See, for example, Song, Storesletten, and Zilibotti (2011), Li (2015) and Hsieh and Song (2015).

6.1 Costly Privatization

A prominent element of the recent Chinese growth experience has been the privatization of public plants. As documented in Cooper, Gong, and Yan (2015), a comparison of plants between a 1998-2000 sample with a later 2005-2007 sample reveals the effects of privatization: (i) a 70% reduction in the number of public plants from 1998-2007, (ii) an almost fourfold increase in the number of private plants, (iii) a dramatic increase in the capital intensity of public plants and in the labor productivity of these plants.

We conduct a counterfactual experiment to quantify the policy implications of labor market interventions on employment and productivity in the process of privatization. Given the shedding of workers by the public sector, the issue is whether these workers obtain jobs in the private sector or end up not participating. The job protection measures have the potential to reduce labor demand by private firms and thus impede the reallocation process and the subsequent productivity gains. The effects on privatization are based on the general equilibrium response of the economy using the estimated parameters for the SCE from 1998-2000 reported in Table 4.

We start from the equilibrium in 1998 where the ratio of firm numbers of state and private sectors and workers' distribution between these two sectors are given from data. The two-sector economy is simulated under the alternative policy regimes, with the policy changes starting in 1998. As in the data, we assume that the public sector sheds labor at a rate of 9.3% per year so that, in the household's problem, N^s decreases at this rate.[49] In each period, labor was reduced at the lowest productivity plants, rather than randomly. We calculate the hypothetical equilibrium 10 years after policy changes, i.e, in 2007.

If there were no frictions, then the reduction in public sector jobs would lead to higher, more productive, private sector employment.[50] However, we are interested in these policies in the presence of adjustment costs and job protection measures in the stationary equilibrium of the model economy.

In addition to looking at employment effects, we study the productivity implications of frictions in privatization. In a multi-sector economy, aggregate productivity decomposes into between and within sector allocation of labor across heterogeneous production sites. Following (12), let j index the sector, public or private (or, exporters or non-exporters in the next section), and, as before, i indexes the production site. Then period t productivity can be written as:

$$p_t = \bar{p}_t + cov(p_{jt}, s_{jt}) \tag{13}$$

so that overall productivity is the unweighted mean plus the covariance across sectors. Within a sector, productivity is given by

$$p_{jt} = \bar{p}_{jt} + cov(p_{ijt}, s_{ijt}) \tag{14}$$

where $\bar{p}_{jt}$ is the unweighted mean of productivity in section j. Here p_{ijt} is productivity at plant i in sector

[49] 9.3% is the average job destruction rate of SCE over 1998-2007 from our data.

[50] As an extreme, consider a frictionless and therefore static model. In equilibrium the consumption of the household is the sum of output from private and public firms, since the household owns the firms and receives transfers from the government. With the base wage pinned down by free entry, the level of consumption is determined by the household first-order condition for labor supply. From this condition, a reduction in public employment leads to an increase in private employment.

j in period t and s_{ijt} is the associated employment share. The first of the expressions focuses on the allocation of labor between sectors and the second one captures within sector variation. These expressions can either be used to decompose profitability or the average product of labor.

Note that labor policies do not have reallocation effects within public sector since they don't affect the public-sector base wage. In addition, we do not get interesting reallocation effects within the private sector since the base wage is not influenced by privatization *per se* in our setting as it is determined by the free entry condition for private plants. Further, the compensation of public sector plants is held fixed. However, since there are spillovers from the public to private firms through the household optimization problem, the policies result in reallocation effects between sectors. These are highlighted in our analysis and are summarized in Table 5.

The results reported in Table 11 are in the 10th year after the implementation of the policy, after N^s drops from its initial level to 0.1878 in 2007. The table reports the participation rates, the productivity decomposition between sectors using average revenue of labor (*apl*), aggregate output and ratio of private firm number to public firm number 10 years after the policy. The row labeled "base" indicates the outcome of the privatization policy without job protection measures. The remaining rows of the table indicate the counterfactual policies in force during this period of privatization.

A couple of key points stand out. First, as noted before, the policy of higher severance pay would have limited the privatization process. Relative to the baseline, this policy lowers the participation rate in the private sector by nearly 9 percentage points, thus reducing the productivity gain and the number of private firms. Finally, output is reduced nearly 1% per year by the introduction of severance pay in 1998.

Second, coupled with credit market liberalization but without the introduction of severance pay, privatization would have had an even bigger impact, increasing the participation rate in private sector by over 20 percentage points, increasing productivity by nearly 27% and increasing the number of private firms. The combination of increased severance pay and credit market liberalization would have lowered the participation rate, but increased both output and productivity.

6.2 Direct Evidence of Policy Effects

This section presents the evidence of the effects of labor regulations on employment following the implementation of the New Labor Contract Law in January 1, 2008. We analyze data from 2007 and 2008 to evaluate the model's prediction that plants which discount the future more respond to the increase in severance pay by increasing employment.

For this exercise, we conduct two specifications, which differ based on the control group. In Specification 1, the treated group is all of the private plants and the control group are the SCE. These are two differences between the control and treated groups. First, the private plants are impacted directly by the policy while the control group is not. Second, the private plants discount more, as established in Table 4. The results of the policy experiment thus combine these two influences.

In Specification 2 the treated group is the domestic plants and the control are the foreign plants. In this case, both groups are affected by the policy, though differentially. The estimates reported in Cooper, Gong,

Table 11: Policy Experiments with Two Sectors: SCE and Private

	Participation Rate			Agg. Productivity		Agg.	Relative
Policy	N^p	N^s	$1 - N^p - N^s$	$E(p_t)$	$c(p_{jt}, s_{jt})$	output	firm #
base	0.5633	0.1878	0.2490	1.1214	0.0292	0.7467	12.0200
fc	0.5637	0.1878	0.2486	1.1204	0.0286	0.7467	12.0184
sp	0.4704	0.1878	0.3419	1.0709	0.0137	0.6699	9.4050
fc(10)	0.5633	0.1878	0.2489	1.1191	0.0279	0.7464	11.9712
cl	0.7674	0.1878	0.0448	1.4278	0.2171	0.9641	21.7861
cl, sp	0.5552	0.1878	0.2571	1.3662	0.1733	0.7629	15.6700
ss	0.5633	0.1878	0.2490	1.1214	0.0292	0.7467	12.0200
he	0.5464	0.1878	0.2659	1.0621	-0.0030	0.7083	11.6533

Notes: This table provides the reallocation effects between private and public sectors in the process of privatization with a counterfactual experiment, in which the labor protection policy was in force in 1998.

1. N^p and N^s are participation rates for private and public sectors. $1 - N^p - N^s$ reprsents the labor non-participation rate. For aggregate productivity (Agg. Productivity) decomposition, $E(p_t) \equiv E(p_{jt} \times s_{jt})$ is the time-series average of the product of the sector weighted average revenue product of labor and the sector employment share, $c(p_{jt}, s_{jt})$ is the time-series average covariance of sector employment share and the sector weighted average revenue product of labor. "Agg. output" is the detrended output per capita produced by private firms and SCE. "Relative firm #" is the number of private firms divided by the number of SCE.

2. The policy experiments of job protection: (i) "base" are the baseline estimates, (ii) "fc" is a 20% increase of the fixed cost, (iii) "sp" increases severance pay by 20%, (iv) "cl" is credit market liberalization, (v) "cl, sp" combines an increase in severance pay with credit market liberalization, (vi) "fc(10)" is an experiment that the fixed firing cost applied for job destruction above 10% rather than the 20% found in the estimation, (vii)"ss" is a 20% increase of base wage, (viii) "he" is a 20% increase of the component of hours compensation, ω_1^p. The public sector is not affected by the policies.

and Yan (2015) suggest that foreign private plants discount the future much less than domestic private plants. Thus this exercise allows us to isolate the effects of differences in discounting on the response to the policy.

We use the following reduced form regression model for our estimation:

$$\Delta e_i = \varphi_0 + \varphi_1 HCC_i + \varphi_2 X_i + \varepsilon_i \tag{15}$$

where Δe_i is the change in employment from year 2007 to year 2008 at firm i, X_i is a set of control variables of firm i, and HCC_i is a dummy variable that equals 1 if firm i is in the treated group.

Tables 12 and 13 report the estimation results. In Table 12, we restrict our analysis to the set of plants with available employment in both years of 2007 and 2008. In Table 13, we take account of employment changes at the closed plants, setting their employment in 2008 to 0. The model in column (i) does not control for any set of firm characteristics. We introduce set of control variables in the models (ii)-(v): change in wage, change in wage and welfare (i.e. fringe benefits), dummies for industries, and dummies for regions. We do not observe wage and welfare payment data for those closed firm in 2008. To calculate the change of wage (the change of wage and welfare), we set the wage (wage and welfare) in 2008 to the mean wage (wage and welfare) per capita, averaging across all plants that continued in operation in 2008. This mean wage (wage and welfare) proxies for the wage (wage and welfare) of the closed plants.

The estimates in the simple model (i) of Table 12 imply a significant increase in size for private (and domestic private) plants relative to state-controlled plants (and foreign private plants). The estimates on the HCC dummy are larger for Specification 1, where the control is the state-controlled plants.

Taking account of the closed plants, as reported in Table 13, results in a larger increase in labor demand for private plants relative to state-controlled firms. This is because the closed state-controlled plants are much larger than the closed private firms. However, taking account of the closed plants adds little to the amount of increase in employment for domestic private firms. Introducing control variables in models (ii)-(v) implies that the private and state-controlled comparison and the domestic private and foreign comparison are similar, whether or not we exclude the closed plants.

7 Exporters

China is an open economy. Chinese economic reforms, started in December 1978 and literally called "reform and opening up", introduced a variety of market principles and opportunities for international trade. China is now considered one of the most open countries.[51]

Exporters, defined as plants with positive revenue from sales abroad, comprise 37% of employment and 26% of the plants over our 1998-2007 sample. Given this exposure to trade shocks and the importance of productivity for trade, it is important to understand how the job protection measures impact these plants.[52]

[51]See the empirical data facts documented in Branstetter and Lardy (2008).

[52]Coşar, Guner, and Tybout (2010) studies trade reforms and labor market frictions in Columbia. See Grieco, Li, and Zhang

We first discuss how the model is extended to include exporters. Parameter estimates are presented for exporting and nonexporting. Finally, the policy interventions are introduced to study their effects on the two types of plants and productivity both within and between the groups.

7.1 Model Revision

The basic elements of the household and plant optimization remain unchanged with the introduction of exporters. For household, the exporting and non-exporting plants provide perfectly substitutable jobs in an integrated labor market.

For the plants, all have labor adjustment costs and maximize the discounted present value of expected profits. The revenues for the exporters come from two sources, sales at home and abroad, rather than one source. Total revenues are captured by (3), though the curvature parameters and the profitability are allowed to depend on export status.[53]

Importantly, the decision to export is taken as given for this exercise. The fact that the policy interventions could impact the dynamic choice of exporting or not is outside the scope of this paper.[54]

7.2 Data and Estimation

Table 14 summarizes the characteristics of exporters and non-exporters in private sector from our sample of 1998-2007 unbalanced panel.[55] Exporters are on average larger in both employment and capital. Exporters have higher labor productivity in terms of revenue per worker and value added per worker, and lower capital productivity. Exporters have larger capital intensity.

Table 3 provides moments for private exporting and non-exporting plants. There are a couple of important differences between these plants. First, exporters have less inaction than non-exporters. Second, exporters have relatively more action in the upper tail of job creation and less action in the upper tail of job destruction. Also, the OLS estimate of the curvature of the revenue function is higher for exporters.

Table 15 reports parameter estimates for these plants. For this estimation, an integrated labor market was imposed so that wages (ω_0^p, ω_1^p) and the hours compensation parameter were fixed at the estimated levels from the private sector baseline. Compared to non-exporters, the exporting plants discount the future less. The linear firing cost is estimated to be much lower for exporters. The curvature of the revenue function is higher for the exporters.

The estimation introduces a new parameter ($\bar{A}$), the mean of profitabllity shock (A). Note that the mean of A was assumed to be 1 in the original model. The estimates of $\bar{A}$ are 1.1033 for exporters and 0.9681 for non-exporters, i.e., A is on average 14% larger for exporters, reflecting a higher averaging profitability, perhaps from TFP for exporters.

(2015) and the references therein for other studies of exporters in China.

[53] This follows from equation (14) in Coşar, Guner, and Tybout (2010).

[54] In fact, there are no estimated models in the literature we are aware of that incorporate the dynamic stochastic export decision and adjustment costs. The closest example is Ruhl and Willis (2008) which does not have adjustment costs.

[55] An exporter in a given year is any plant exporting in that year. Exporters do not necessarily export in each year of the sample.

7.3 Response to Policy

Given these estimates, we study the effects of the job protection measures on exporters and non-exporters. The finding that exporters have a higher discount factor than non-exporters, 0.949 compared to 0.926.

The policy analysis starts with a stationary equilibrium in 2007 given the initial firm distribution between two sectors (the ratio of non-exporter number to exporter numbers is 2.76 in 2007). Two panel data sets, one based on parameters in exporter sector and the other based on parameters in non-exporter sector are created. Any changes in wages induced by the policy are common to both sectors. Moments from a new stationary equilibrium are calculated.

Table 16 presents employment and productivity effects within each sector. As in the earlier analysis summarized in Tables 5 and 6, the two policies that matter most are the "sp" and "cl" treatments.

As in the earlier discussion, the differences in the discount factor between exporters and non-exporters is key to understanding their differential policy response. The "sp" experiment leads to large effects on non-exporters, increasing firm size by 6% and reducing productivity by 3%. Due to the higher discount factor, the policy has negligible effects on exporters. Credit market liberalization, the "cl" case, reduces firm size and increases productivity in both sectors.

Table 17 presents policy effects across sectors. In the "sp" case, overall employment is reduced in both sectors. Because the firm size of exporters is essentially unchanged, as shown in Table 16, there are less exporters exiting than non-exporters. Further, aggregate output is reduced by 9% and productivity is reduced by 3%. The credit liberalization leads to the largest employment effect as the participation rates rise by nearly 7 percentage points in total, with both sectors expanding their employment, though the median firm size in both sectors is lower. The aggregate productivity effect is largest under credit market liberalization, with an increase of nearly 22%. In contrast, productivity and output fall when severance pay is increased.

Table 12: Reduced-Form Estimation Results for Change in Employment, Excluding Closed Plants

	Specification 1					Specification 2				
	Model					Model				
Independent variable	(i)	(ii)	(iii)	(iv)	(v)	(i)	(ii)	(iii)	(iv)	(v)
HCC dummy	9.13	11.58	12.37	16.93	16.20	11.82	14.33	14.65	11.55	11.84
	(2.67)	(3.26)	(3.28)	(3.47)	(3.53)	(1.30)	(1.48)	(1.51)	(1.43)	(1.45)
Change in wage [a]	-	0.0016	-	-	-	-	0.0011	-	-	-
	-	(0.0006)	-	-	-	-	(0.0006)	-	-	-
Change in wage and welfare [b]	-	-	0.0015	0.0015	0.0015	-	-	0.0011	0.0011	0.0011
	-	-	(0.0005)	(0.0005)	(0.0005)	-	-	(0.0006)	(0.0006)	0.0006
Controls for industry [c]	no	no	no	yes	yes	no	no	no	yes	yes
Controls for region [d]	no	no	no	no	yes	no	no	no	no	yes

Notes: Standard errors are given in parentheses. All models include an unrestricted constant (not reported).
[a] The change in per capita annual wage from year 2007 to 2008.
[b] The change in per capita annual wage plus welfare payment from year 2007 to 2008.
[c] Dummy variables for 519 industries (4-digit) are included.
[d] Dummy variables for 30 provinces are included.

Table 13: Reduced-Form Estimation Results for Change in Employment, Setting employment at Closed plants to 0

	Specification 1					Specification 2				
	Model					Model				
Independent variable	(i)	(ii)	(iii)	(iv)	(v)	(i)	(ii)	(iii)	(iv)	(v)
HCC dummy	51.64	55.24	56.25	57.97	58.48	11.74	13.08	13.37	11.54	12.19
	(3.81)	(4.11)	(4.13)	(4.37)	(4.49)	(1.24)	(1.36)	(1.38)	(1.33)	(1.35)
Change in wage [a]	-	0.0017	-	-	-	-	0.0012	-	-	-
	-	(0.0007)	-	-	-	-	(0.0007)	-	-	-
Change in wage and welfare [b]	-	-	0.0016	0.0016	0.0016	-	-	0.0012	0.0012	0.0012
	-	-	(0.0005)	(0.0005)	(0.0005)	-	-	(0.0006)	0.0006	0.0006
Controls for industry [c]	no	no	no	yes	yes	no	no	no	yes	yes
Controls for region [d]	no	no	no	no	yes	no	no	no	no	yes

Notes: Standard errors are given in parentheses. All models include an unrestricted constant (not reported).
[a] The change in per capita annual wage from year 2007 to 2008. For plants closed in 2008, the wage in 2008 is set to the mean annual wage per capita, averaging across all plants which were in operation in 2008.
[b] The change in per capita annual wage plus welfare payment from year 2007 to 2008. For plants closed in 2008, the wage plus welfare in 2008 is set to the mean per capita wage plus welfare payment, averaging across all plants which were in operation in 2008.
[c] Dummy variables for 519 industries (4-digit) are included.
[d] Dummy variables for 30 provinces are included.

Table 14: Characteristics of Private Plants by Exporters and Non-Exporters: 1998-2007 Unbalanced Panel

	Non-Exporters	Exporters
# plants	109,761	45,601
Value added (Va.)	10,207.85	18,975.47
	(25,149.08)	(61,085.12)
Revenue (Rev.)	34,799.14	71,438.20
	(87,605.83)	(267,453.00)
Employment (Emp.)	125.00	268.84
	(117.63)	(289.61)
Capital (Cap.)	10,358.70	21,867.04
	(30,618.63)	(89,355.28)
Cap./Emp.	71.10	112.58
	(9.96)	(9.33)
Va./Emp.	67.33	77.85
	(24.50)	(21.84)
Va./Cap.	1.03	0.89
	(0.22)	(0.19)
Rev./Emp.	235.13	293.70
	(82.17)	(80.26)
Rev./Cap.	3.57	3.29
	(0.70)	(0.67)

Notes: All monetary terms are in 1,000 RMB Yuan, deflated to 2005 level. The trimmed sample excludes the upper and lower 2.5% tails by employment size. Capital is calculated by the book value of fixed asset net of depreciation. To control for industry effects, we follow Hsieh and Song (2015) and use industry labor share to weight capital intensity (Cap./Emp.), value added per worker (Va./Emp.), value added per unit of capital (Va./Cap.), revenue per work (Rev./Emp), and revenue per unit of capital (Rev./Cap.) for each industry. Standard deviations are given in parentheses.

Table 15: Parameters Estimates: Exporters, and Non-Exporters

ζ	ν	F^{+}	F^{-}	γ^{+}	γ^{-}	β	Γ	α	ρ	σ	ω_0^p	ω_1^p
All Private: 1998-2007												
1.562	0.515	0.035	0.040	0.032	0.105	0.922	486.333	0.309	0.983	3.485	0.129	2.942e-4
(0.072)	(0.055)	(0.010)	(0.016)	(0.006)	(0.011)	(0.025)	(55.239)	(0.006)	(0.001)	(0.072)	(0.011)	(8.558e-5)
Exporters: 1998-2007												
1.562	0.630	0.056	0.047	0.001	0.063	0.949	902.733	0.344	0.989	3.394	**0.129**	**2.942e-4**
(0)	(0.021)	(0.015)	(0.019)	(0.006)	(0.006)	(0.004)	(42.459)	(0.006)	(0.000)	(0.057)	(0)	(0)
Non-Exporters: 1998-2007												
1.562	0.510	0.034	0.017	0.065	0.108	0.926	455.611	0.298	0.978	3.484	**0.129**	**2.942e-4**
(0)	(0.012)	(0.003)	(0.006)	(0.005)	(0.005)	(0.003)	(12.758)	(0.005)	(0.001)	(0.043)	(0)	(0)

Notes: The standard errors are in parentheses. The threshold for the fixed firing cost applies to all sectors is 20%. For exporters and non-exporters, the parameters ζ, ω_0^p, and ω_1^p are set at the values of the privates. Since we have adjusted the unit of revenue (or profitability shock A) in each sector, the values of adjustment cost parameters are comparable across sectors.

Table 16: Policy within Sector Effects: Exporters and Non-Exporters

	Exporter Sector			Non-Exporter Sector		
Policy	EMP^e	$E(\hat{p}_t^e)$	$c(apl_{it}^e, s_{it}^e)$	EMP^n	$E(\hat{p}_t^n)$	$c(apl_{it}^n, s_{it}^n)$
base	305.1875	1.1692	0.1856	143.8629	1.4050	0.2398
fc	305.1892	1.1687	0.1854	143.8637	1.4046	0.2395
sp	305.3413	1.1680	0.1904	152.3826	1.3632	0.2454
cl	272.9278	1.4023	0.1973	115.4047	1.7165	0.2817
fc(10)	305.2881	1.1663	0.1869	142.5805	1.4027	0.2398
cl, sp	311.0428	1.1965	0.1874	119.6260	1.4437	0.3104
ss	305.1875	1.1692	0.1856	143.8629	1.4050	0.2398
he	322.5754	1.1159	0.1716	142.0154	1.3325	0.2349

Notes: 1. EMP^e and EMP^n are median establishment size for exporters and non-exporters, respectively. $E(\hat{p}_t) \equiv E(apl_{it} \times shr_{it})$ is the time-series average of the product of the average revenue product of labor and the establishment employment share, $c(apl_{it}, s_{it})$ is the time-series average covariance of employment share and the average revenue product of labor at the establishment.

2. The policy experiments apply to both exporters and non-exporters, including: (i) "base" are the baseline estimates, (ii) "fc" is a 20% increase of the fixed cost, (iii) "sp" increases severance pay by 20%, (iv) "cl" is credit market liberalization, (v) "cl, sp" combines an increase in severance pay with credit market liberalization, (vi) "fc(10)" is an experiment that the fixed firing cost applied for job destruction above 10% rather than the 20% found in the estimation, (vii)"ss" is a 20% increase of base wage, (viii) "he" is a 20% increase of the component of hours compensation, ω_1^p.

Table 17: Policy Experiments with Two Sectors: Exporters and Non-Exporters

	Participation Rate		Agg. Productivity		Agg.	Relative
Policy	N^e	N^n	$E(p_t)$	$c(p_{jt}, s_{jt})$	output	firm #
base	0.2087	0.3554	1.4776	0.0613	0.4956	2.7634
fc	0.2088	0.3554	1.4772	0.0613	0.4956	2.7634
sp	0.1860	0.3248	1.4326	0.0530	0.4494	2.6811
cl	0.2295	0.3940	1.8047	0.0829	0.6174	2.9110
fc(10)	0.2089	0.3554	1.4752	0.0614	0.4954	2.7634
cl, sp	0.2216	0.3859	1.5173	0.0669	0.5190	3.1477
ss	0.2087	0.3554	1.4776	0.0613	0.4956	2.7634
he	0.2040	0.3544	1.4005	0.0583	0.4707	2.8831

Notes: 1. N^e and N^n are participation rates for exporter and non-exporter sectors. For the aggregate productivity decomposition, $E(p_t) \equiv E(p_{jt} \times s_{jt})$ is the time-series average of the product of the sector weighted average revenue product of labor and the sector employment share, $c(p_{jt}, s_{jt})$ is the time-series average covariance of sector employment share and the sector weighted average revenue product of labor. "Agg. output" is the detrended output per capita produced by exporters and non-exporters. "Relative firm #" is the number of non-exporters divided by the number of exporters.

2. The policy experiments apply to both exporters and non-exporters, including: (i) "base" are the baseline estimates, (ii) "fc" is a 20% increase of the fixed cost, (iii) "sp" increases severance pay by 20%, (iv) "cl" is credit market liberalization, (v) "cl, sp" combines an increase in severance pay with credit market liberalization, (vi) "fc(10)" is an experiment that the fixed firing cost applied for job destruction above 10% rather than the 20% found in the estimation, (vii) "ss" is a 20% increase of base wage, (viii) "he" is a 20% increase of the component of hours compensation, ω_1^p.

8 Conclusion

This paper studies the effects of labor market policies and credit market liberalization in China on firm size, aggregate employment, productivity and output. Using a model of dynamic labor demand estimated from moments prior to the introduction of policy measures, we characterize the impact of these new policies.

There are a couple of key findings. First the policy of increased severance payments has a sizable impact on plant size, employment, productivity and output. Since we estimate a relatively low discount factor, the increase in severance pay leads to an increase in median firm size. This policy also leads to a higher covariance between employment share and average labor productivity, which is indicative of a less efficient cross-sectional allocation of labor services. Second, credit market liberalization would induce a reduction in plant size once plants discount future firing costs less heavily.

The analysis studies the interaction between these interventions. This interaction is important for policymakers to recognize. We find that the plant size increase from a severance pay increase is reduced when this policy is combined with modest credit market liberalization.

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