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ABSTRACT

This paper studies the employment and productivity implications of new labor regulations in China. These new restrictions are intended to protect workers' employment conditions by, among other things, increasing firing costs and increasing compensation. We estimate a model of costly labor adjustment from data prior to the policy. We use the estimated model to simulate the effects of the policy. We find that increases in severance payments lead to sizable job creation, a significant reduction in labor reallocation and an increase in the exit rate. A policy of credit market liberalization will reduce employment, slightly increase labor reallocation and reduce exit. The estimated elasticity of labor demand is about unity so that an increase in the base wage leads to sizable job losses.

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1 Motivation

In January 2008, China enacted numerous measures to protect workers. These actions were motivated, in part, by concerns over the employment situation of workers, including job security and wage levels. Often well-intentioned interventions of this form have unintended adverse consequences. The increased firing costs can have an adverse effect on labor demand and may induce exit from an industry. These effects are likely to be most severe during an economic downturn, such as that of late 2008 and 2009.[1]

Table 1 in Allard and Garot (2010) compares the scores of different countries on the Employment Protection legislation indicator, which was developed by the OECD to gauge the strictness of labor laws. From this table, the new labor law moves China from a fairly deregulated market to one that could be considered as restrictive as some of the most protective European economies, and much more restrictive than the United States. Allard and Garot (2010) draw particular attention to the increased severance payments, noting that they are now comparable to those found in rigid OECD labor markets, such as Spain and Portugal. From the World Bank, the value of the "Difficulty of firing index" for China rose more than 20% between 2005 and 2009.[2]

In this paper we study the effects of these labor regulations. We estimate a model of dynamic labor demand, using observations prior to the labor regulations. The estimates from the model of structural parameters are used for the policy analysis.

The policies we consider include: (i) the increase of fixed hiring costs, (ii) increased costs of varying worker hours (overtime provisions), (iii) increases in severance pay, (iv) increases in base wages and (v) the liberalization of capital markets.

We study how these policy interventions influence average employment and worker reallocation. To the extent that these interventions influence the costs of employment and the costs of adjusting employment, they ought to be reflected in the demand for labor and in the pace of worker reallocation across heterogeneous producers. Our model estimates the underlying adjustment costs which are augmented by some of these interventions.

We find that the main effects of the interventions come through the increased severance pay-

[1] Analyses of these regulations in Europe, for example Bentolila and Bertola (1990a) and the references therein, looked at the effects of increased firing costs on hiring and unemployment.

[2] This comes from various issues of the World Bank "Doing Business" reports.

ments, the liberalization of capital markets and increases in base wages.[3] With our estimates, 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. 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 employment is muted when capital markets are liberalized and the discount factor rises to 0.95. We thus conclude that the affects of increased severance pay on employment and productivity interact with the access of plants to capital markets.

Further, we find evidence that the elasticity of labor demand is about unity for Chinese private plants. This implies that a 20% increase in the base wage of workers will lead to a 20% reduction in employment. This estimate of the elasticity of labor demand is very robust across parameterizations of our dynamic labor demand model.

2 China's Labor Policies

This section discusses the reforms in China.[4] 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.

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 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 Peoples Republic of China (Employers).

[3]The estimation and policy analysis starts with a model in which exit is not an option. We then introduce exit, re-estimate and find that our results are robust to allowing this possibility.

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

> 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.
>
> Article 3 The conclusion of a labor contract shall be based on the principles of lawfulness, fairness, equality, voluntariness, negotiated consensus and good faith. A lawfully concluded labor contract shall have binding force, both the Employer and the employee shall perform their respective obligations stipulated therein.
>
> Article 4 Employers shall formulate and improve labor rules and regulations in accordance with the law, so as to ensure that employees enjoy their labor rights and perform their labor obligations.

The specifics needed to implement these goals are contained in Chapter IV of the new law. As we shall see, one of the most economically important provisions is the requirement of severance payment upon separation. In addition, the new laws call for the provision of social insurance.

As noted earlier, the severance pay provisions are viewed as most onerous. Before the implementation of new law, the employer was not required to provide a severance payment if an existing employment contract expired without being renewed. The new law changes this so that severance pay is required unless an offer to renew the same contract is rejected by the employee. Further, 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 if a contract is terminated unlawfully. Evidently, a significant part of lay-offs in which contracts are not expired are considered unlawful termination.

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 since these parts are the ones most likely to be influenced by these new policies. These plants account for over 75% of total employment. Thus we interpret the policy changes as being more about enforcement than actual policy changes.

As with any new regulation, there is the open question of enforcement. 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 from 2007. From the U.S. Congressional Commission on China, we learn Reports on disputes in 2009 show that 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.[5]

To provide further evidence, we conducted an informal survey of plants and the New Labor Contract Law (NLCL).[6] 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 labor cost by	>30%	20 to 30%	10 to 20%	< 10%
	4	8	0	0
Law authorities inspect	very strictly	strictly	not strictly	
implementation of NLCL	5	6	1	

When asked about what 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 increases every year.

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

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

- The minimum wage increases steadily every year.
- Recruitment becomes difficult. In the mean time, labor mobility is very large. The newly hired graduated-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 4 gives workers the right to politically participate the activities in the enterprise, which make the operation difficult and hard to reach agreement.
- Article 14 where the non-fixed term (tenured) contract makes enterprises in a very unfavorable situation.
- Article 20 increases the cost of new hires. It shortens the probation time and increases the salary for novices. Novices are unskilled worker whose wages was paid on piecework.
- 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.

As we proceed, some of these elements of change from the NLCL will be central to our model, such as the increased (social) insurance payments for workers, increased severance payments and increases in the elasticity of compensation with respect to hours. To the extent that the increased hiring costs are in the form of higher wages, these costs are incorporated into our analysis as well. Others, such as the difference between temporary and fixed contracts is not part of our baseline environment.

3 Dynamic Optimization

In this section we present the dynamic optimization problem of private plants. 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.

The dynamic optimization problem for a plant of a privately owned firm builds from the specification in Cooper, Haltiwanger, and Willis (2004) and Cooper, Gong, and Yan (2010). 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} is the stock of workers employed in the previous period.

The 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.[7]

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

$$V(A, e_{-1}) = \max_{h,e} R(A, e, h) - \omega(e, h) - C\left(A, e_{-1}, e, h\right) + \beta E_{A'|A} V(A', e) \tag{1}$$

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.[8]

The revenue function 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 elastic demand, the revenue function takes the form in (2). 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:

$$R(A, e, h) = A(eh)^{\alpha}. \tag{2}$$

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

[8] The model is estimated from cross sectional variation by removing year effects.

The compensation paid to workers is characterized by

$$\omega(e,h) = e(\omega_0 + \omega_1 h^{\zeta}). \tag{3}$$

This function is an important determinant of how the firm varies its labor input in the face of a change in profitability: through variations in hours or in the number of workers. The parameters (ω_0, ω_1) are set to mimic average hours and average plant size. The parameter ζ determines the elasticity of compensation with respect to variation in hours.[9] Though hours variation is historically small in China, it is nonetheless important to consider this aspect of the demand for labor. 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.

The cost of adjusting the stock of workers is given by $C(A, e_{-1}, e, h)$. In general, this function captures the various inputs into the process of hiring a worker, including: search, recruitment and training costs. It may contain both convex and non-convex forms of adjustment costs.[10]

A general cost of adjustment function would be

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

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

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

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

There are four 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. The parameter λ is an opportunity cost of adjustment: the plant losses a fraction $(1 - \lambda)$ of its revenues when it adjusts its labor force. A fixed cost of adjustment is parameterized by F. Finally, there are linear adjustment costs. The linear firing cost, γ^{-}, is of particular importance as it captures severance payments to workers. One of the key features of the data is inaction in employment

[9] When ω_0 is zero, the elasticity of compensation with respect to hours is ζ.

[10] Hamermesh and Pfann (1996) contains a lengthly discussion of adjustment costs models and their interpretation.

adjustment. The opportunity cost, fixed cost and linear costs are all capable of creating inaction.

In addition to the differences in adjustment costs of hiring and firing workers, this study adds another feature: the use of thresholds 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.

4 Estimation

We first discuss the data and then the estimation procedure. Some additional details are provided in the Data Appendix.

4.1 Data

The data used in this study and in Cooper, Gong, and Yan (2010) are from Annual Surveys of Industrial Production (1998-2007), conducted by the National Bureau of Statistics (NBS) of China. The panel used in that study includes all private plants with more than five million Yuan in revenue.[11] Initially we focus on a balanced panel of private plants in operation during the period 2005-2007. Later we discuss entry and exit. Private plants are identified through a variable, **control of shares**, which indicates ownership shares.

Data moments are reported in the first row of Table 4. There are a couple of key features of the data which are important in the estimation. The first is inaction: about 37% of the observations entail essentially no net change in the number of workers.[12] The second is the presence of significantly large employment changes. Over 20% of the observations entail job creation in excess of 20% of the workforce and over 10% have job destruction in excess of 20% of the plant work force. Yet, about 20% of the observations have 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.

[11] From the discussion in Brandt, Biesebroeck, and Zhang (2012), this cut-of based on revenues is likely to eliminate less than 1% of the private plants.

[12] Importantly, we observe only net flows, not gross hires and fires.

Table 2: Revenue Function Estimation

method	α	ρ
OLS	0.6695	0.8975
	0.0015	0.0010
IV	0.3198	0.9082
	0.0032	0.0011
LP	0.2017	0.9407
	0.0015	0.0008

These are results for a balanced panel. Standard errors are indicated below the parameter estimates.

4.2 Results

The estimation procedure contains two steps. The first involves estimation of the revenue function directly from the data without any need to solve the dynamic optimization problem. The estimates provide a measure of the curvature of the revenue function and the parameters of the shock processes. The second step is the estimation of the structural parameters, particularly those for the adjustment costs, using a Simulated Method of Moments approach.

4.2.1 Revenue Function Estimates

The estimates of the revenue function are summarized in Table 2. The first part of the table shows the results for balanced panel, estimates are reported for OLS, IV and the Levinsohn-Petrin (LP) procedure. The second part shows IV estimates where the instruments were the capital stock and an initial wage, used to proxy for unobserved managerial and worker ability. The value of α decreases, consistent with a positive correlation between unobserved profitability shock and employment.

The last row shows the results using the estimation approach of Levinsohn and Petrin (2003). In that approach, the unobserved profitability shock is proxied for by observed input of intermediate goods. The estimate of α is considerably lower in this case, relative to the IV and OLS results. We use the LP estimates of α, ρ for the estimation. The estimation process also generates an estimate of the standard deviation of the innovation to the profitability shock. Instead of using that estimate, we instead adjust this standard deviation to match the employment size distribution of plants.[13]

[13] The values we use for σ is 2.5, slightly larger than the estimate from the revenue function. We set σ to match the min and max of plant size, not the mean.

The estimates of the revenue function are far from the constant returns to scale, perfect competition case in which $\alpha = 1$. Instead there is sizable curvature. One interpretation of the curvature is market power. With a factor share of about 0.35 for labor in China and assuming constant returns to scale, the estimated elasticity of demand is about -1.72 and the markup is, on average, about 2.42.[14]

4.2.2 Estimating Adjustment Costs and the Discount Factor

The main challenge to the estimation is to match these prominent features of the data shown in Table 4. 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 usually not imply these small adjustments. Our specification of adjustment costs allows for the non-convexity to appear after a threshold of adjustment.

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

The remaining parameters are estimated via SMM. This approach finds the vector of structural parameters, denoted Θ, to minimize the weighted difference between simulated and actual data moments:

$$\pounds(\Theta) \equiv (M^d - M^s(\Theta))W(M^d - M^s(\Theta))'. \tag{6}$$

Table 4 indicates the moments used in the estimation. The moments were intended to capture the cross sectional distribution of employment adjustment (job destruction and creation) as well as the serial correlation of employment, sc. In addition, 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.

[14] As discussed in Cooper, Haltiwanger, and Willis (2004) and the related literature, α is given from the optimization over capital in the fully specified production function $\tilde{R}(A,e,h,K) = \left(\tilde{A}(eh)^{\alpha_e} K^{\alpha_K}\right)^{\frac{\eta-1}{\eta}} - rK$ where α_e and α_K are the respective labor and capital shares, $-\eta$ is the price elasticity of demand for the good, and r is the rental rate on capital. Maximization with respect to capital leads to the reduced form revenue function over total hours with an exponent given by $\alpha = \frac{\frac{\eta-1}{\eta}\alpha_e}{1-\frac{\eta-1}{\eta}(1-\alpha_e)}$.

The parameters estimated by SMM are $\Theta \equiv (\zeta, \nu, \lambda^+, \lambda^-, F^+, F^-, \gamma^+, \gamma^-, \beta)$.[15] The moments were selected in part because they are informative about these underlying parameters. Roughly speaking, the curvature of the compensation function is identified from the standard deviation of the log of revenue per worker.[16] An increase in ζ will lead to a larger variation in employment relative to hours and thus a reduction in this moment. The quadratic adjustment cost parameter, ν, is identified largely from variations in the serial correlation of employment and from the prevalence of employment adjustments in the 10% range. The distribution of employment changes, particularly the inaction and the large adjustments, act to pin down the non-convex adjustment costs. Finally, 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 employment adjustment are more heavily discounted and so the plant relies more on hours adjustment.

The estimation method starts by solving the dynamic programming problem in (1) 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 the process estimated in the first stage. Given these shocks and the decision rules at the plant level, a simulated panel data set is created and the simulated moments are calculated. The weighting matrix, W, is obtained by inverting an estimate of the variance/covariance matrix obtained from bootstrapping the data.

A subset of the cost of adjustment parameters were estimated in turn. The parameter estimates for the leading case of firing and hiring costs are given in the first row of Table 3. In contrast to Cooper, Gong, and Yan (2010), hiring and firing costs were jointly estimated. The estimated hiring costs were essentially zero. The moments for this estimated model are given in Table 4.

An important parameter is the estimate of the linear firing costs, $\gamma^- = 0.013$. This is about 13.5% of annual wages paid to a worker, or a bit more than 1.5 months of salary.[17]

The estimated discount factor of 0.917 is low relative to the discount factor of 0.95 or 0.96 assumed in many macroeconomic model. It is noteworthy that this estimated discount factor is consistent with capital market imperfections associated with private plants in China.[18]. The experiment labeled "cl", denoting capital market liberalization, increases the discount factor to 0.95

[15] Cooper, Haltiwanger, and Willis (2004) do not estimate asymmetric adjustment costs.

[16] We do not have direct information on hours in the data set.

[17] This is calculated in the simulated data from the ratio of the estimate of γ^- to the mean wage received per worker.

[18] See the discussion and references in Song, Storesletten, and Zilibotti (2011).

and we also will study the interaction of credit market liberalization with other policy measures.

Parameter estimates for other cases are presented in the Appendix. The model with fixed and linear costs fit the data moments better than one with opportunity costs. It also fits the data better than models with just hiring costs or quadratic adjustment costs.

Table 3: Parameters Estimates and Policy Experiments

policy	ζ	ν	F^+	F^-	γ^+	γ^-	β
baseline	2.157	0.013	0.000	0.009	0.000	0.013	0.917
std. errors	0.004	0.0001		0.0003		0.0001	0.004
fc	2.157	0.013	0.000	0.019	0.000	0.013	0.917
sp	2.157	0.013	0.000	0.009	0.000	0.026	0.917
he	2.373	0.013	0.000	0.009	0.000	0.013	0.917
cl	2.157	0.013	0.000	0.009	0.000	0.013	0.950
cl,sp	2.157	0.013	0.000	0.009	0.000	0.026	0.950
fc(10)	2.157	0.013	0.000	0.009	0.000	0.013	0.917
bw	2.157	0.013	0.000	0.009	0.000	0.013	0.917

Here: (i) baseline are the baseline estimates, with standard errors for all parameters except the hiring costs (ii) fc is a doubling of the fixed cost, (iii)sp is a doubling of severance pay, (iv) he is an increase in the hours elasticity of 10%, (v) cl is credit market liberalization, (vi) cl, sp combines an increase in severance pay with credit market liberalization, (vii) $fc(10)$ applies the baseline firing cost at a 10% job destruction rate and (viii) bw increase of base wage by 20%.

The moments for the baseline parameters are indicated in Table 4. The estimated model does fine with matching the standard deviation of revenue per worker as well as the serial correlation of employment. The model produces a bit too much inaction and does not quite capture the job creation rates over 30%.

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%. There are essentially no hiring costs so that low job creation rates are not difficult to match. The inaction is a consequence of the linear firing costs.

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

Table 4: Moments for plants

	std(r/e)	sc	JC30	JC1020	JC10	inaction	JD10	JD1020	JD30
Data	0.975	0.922	0.151	0.073	0.119	0.37	0.101	0.051	0.056
baseline	0.939	0.975	0.100	0.075	0.124	0.406	0.071	0.058	0.058
fc	0.950	0.975	0.100	0.074	0.115	0.412	0.070	0.058	0.046
sp	1.179	0.981	0.056	0.044	0.089	0.606	0.057	0.051	0.029
he	0.932	0.975	0.100	0.074	0.124	0.409	0.070	0.058	0.059
cl	0.914	0.973	0.106	0.079	0.118	0.405	0.067	0.058	0.060
cl,sp	1.109	0.978	0.067	0.048	0.096	0.577	0.052	0.047	0.036
fc(10)	0.941	0.974	0.100	0.073	0.117	0.412	0.070	0.080	0.070
bw	0.867	0.971	0.119	0.077	0.122	0.376	0.064	0.060	0.066

In this table, std(r/e) is the standard deviation of the log of revenue per worker, sc is the serial correlation in 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 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.

the prospects of firing and thus the costs associated with job destruction.

The Appendix also includes a matrix, Table 13, summarizing the effects of small variations in parameter values on the simulated moments. This matrix provides information on the nature of the identification. These derivatives underlie the standard errors for the estimated model, presented in Table 3.[19]

5 Policy Implications

We use the estimated model to study the effects of recent job protection measures. 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 of movements created by these policy actions. We look at the effects of these policies on employment and productivity.

Reflecting both model and parameter uncertainty, we present evidence of the robustness of our findings to variations in the parameters of the estimated model and also to competing models. Further, given that the policies can promote exit, we supplement the discussion with a study of the

[19] As the fixed and linear hiring costs are estimated at zero, we are not able to create a window around the point estimate in order to compute standard errors.

implications of the policies for firm exit.

5.1 Policies

Here is how we go from the presentation of the Chinese policies in section 2 to changes in parameter values. These changes are summarized by the various rows of Table 3.

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", doubles this fixed cost. 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 doubling of the linear firing costs. As noted earlier, the estimated linear firing cost could be interpreted as severance payment of a bit more than 1.5 months of average wages. This experiment, labled "sp" amounts to an increase in severance pay to cover about 3 months of average wages. Under the new policies, this is the compensation owed to a worker retained for three years. Our model does not include heterogeneous workers so the effects of this policy on the tenure composition of the work force, while interesting, is excluded.

The enforcement of overtime provisions means that hours variation is more costly. The treatment labeled "he" increases the elasticity of compensation with respect to hours, parameterized by ζ in (3), by 10%.

As we shall see, it is of interest to combine the experiments of increasing severance pay with capital market liberalization. This experiment is labeled "cl,sp".

There is an experiment associated with a 20% increase in the base wage, ω_0. This case is labeled "bw". This experiment captures the increased social security insurance 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.

To be clear, in the other experiments, the parameters of the wage function are held fixed at their baseline levels. Thus the policy effects are analyzed assuming that the effects of these experiments on wages are negated by government action. So, for example, in the "he" experiment, the increased cost of hours variation are **not** offset by wage changes. Thus average hours and employment size are not kept at the baseline levels.

5.2 Employment Effects

Table 5 summarizes the implications of the policies on employment and productivity. The policies are listed as rows. The first column is the average employment level, where the average is both across plants and time.

Relative to the baseline, the policy experiments associated with variations in the fixed costs of firing, "fc" and "fc(10)" have relatively small effects on the average level of employment. From Table 4 these policies, particularly the fc(10) experiment, do impact on the distribution of job creation and destruction rate, but these effects tend to average out and not influence average employment.

Likewise, the employment effects of overtime provision, the "he" experiment has little effect on average employment. From Table 4 this policy does reduce the $std(r/e)$ moment since employment variations play a more important role in adjusting the labor input once hours variations are more expensive.

There are relatively large employment effects for variations in severance pay, credit liberalization and increases in the base wage. Interestingly, these effects also interact.

An increase in severance pay, the "sp" experiment leads to a 20% increase in employment. 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. Hopenhayn and Rogerson (1993) find that an increase in linear firing costs reduces employment while Bentolila and Bertola (1990b) find that employment rises when firing costs increase.

In our model, we can trace this employment 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 employment. This asymmetric response is driven by the low discount factor so that job creation responds to the current

Table 5: Policy Experiments

Policy	Employment		Productivity				
	E(e)	reall.	Ep_t	$cov(A_{it}, s_{it})$	$E_t(std_i(arlp_{it}))$	$cov(e_{it}, arpl_{it})$	$cov(A_{it}, arpl_{it})$
base	389.382	0.131	5.663	2.930	0.036	6.460	0.106
no ac	456.921	0.565	8.381	5.655	0.000	0.000	0.000
fc	390.049	0.130	5.639	2.905	0.036	6.475	0.106
sp	436.932	0.074	4.774	2.039	0.039	5.976	0.125
he	384.859	0.131	5.655	2.922	0.033	5.885	0.098
cl	369.335	0.139	5.742	3.009	0.036	6.595	0.108
cl,sp	383.705	0.087	5.024	2.289	0.041	6.230	0.130
fc(10)	388.966	0.131	5.656	2.923	0.036	6.489	0.106
bw	313.113	0.151	5.911	3.179	0.040	6.321	0.118

For the employment numbers, E(e) is the mean establishment size and "reall" is the mean level of reallocation, defined as the sum of job creation and job destruction. For the productivity means, $E(p_t) \equiv E(A_{it} \times shr_{it})$ is the time-series average of the product of the profitability shock and the establishment employment share, $cov(A_{it}, shr_{it})$ is the time-series average covariance between the profitability shock and the employment share, $E_t(std_i(arlp_{it}))$ is the time-series average standard deviation of the average revenue product of labor, $cov(e_{it}, arpl_{it})$ is the time-series average covariance of employment and the average revenue product of labor at the establishment and $cov(A_{it}, arpl_{it})$ is the time-series average covariance of the profitability shock and the average revenue product of labor at the establishment.

shock and the future prospects of costly job destruction are given less weight.

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

The "cl, sp" experiment shows that the increase in severance payments coupled with an increase in the discount factor leads to a contraction in employment relative to the baseline. This interaction is important since it might be natural to combine job protection measures with those that would increase the capital market access of firms.

This combination of policy changes does seem to be taking place in China recently, though not as part of an integrated policy. In particular, in late 2011 the Chinese government unfroze credit, provided financial support and relieved tax loads for private enterprises.

Large employment effects arise from variations in the base wage, the "bw experiment". The 20% increase in the base wage is associated with an employment reduction of slightly over 20%: the elasticity of labor demand equals -1.

5.3 Productivity Effects

Hsieh and Klenow (2009), Song, Storesletten, and Zilibotti (2011) and Deng, Haltiwanger, McGuckin, Xu, Liu, and Liu (December 2007) have chronicled the important of reallocation for the growth process of China. Those studies focus on the period of transformation during the 1990s and the 2000s. Our focus, in contrast, is with the productivity implications of policy interventions. These effects arise in two principal 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. We study this second effect below when we introduce exit into the model.

The second column under "Employment" in Table 5 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.

It is useful to use both the baseline and an experiment with no frictions as reference points.[20] In the frictionless case, labeled "no ac" in Table 5, the reallocation rate is considerably larger than in the baseline model, reflecting the large variability of the plant-specific profitability shocks.

Relative to the baseline, the large affects on reallocation come from the "sp" intervention, where job destruction, job creation and thus reallocation are reduced significantly. This effect is consistent with the explanation for the employment creation of increased severance pay. The increased cost of job separations reduces job destruction and thus relatively low productivity plants are left with too many workers.

A similar effect, though not as large, comes from the mixture of credit market liberalization and the increase in severance pay. It is interesting that though this mixture of policies tends to mitigate the effects of severance pay on employment, the distortions due to the increased frictions from the higher cost of separations remains.

The effects of these policies on productivity are found in the last five columns. We study a couple of measures of the misallocation of labor on productivity. For this discussion, it is useful to

[20]The no frictions case is the same parameterization as the baseline except adjustment costs are set to zero.

think of a large economy producing a single product with differences in productivity across plants. In this way, the reallocation is linked to total output rather than its composition.

Let $s_{it} \equiv \frac{e_{it}}{\sum_j e_{jt}}$ be the share of employment at establishment i in period t. Then the weighted profitability in period t is given by $p_t \equiv E(A_{it} \times s_{it})$. Olley and Pakes (1996) decompose p_t as

$$p_t = \bar{p}_t + cov(A_{it}, s_{it}). \tag{7}$$

The average weighted profitability shock, Ep_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 loses are largest in the "sp" experiment alone and then this policy is combined with credit market liberalization.

It is also useful to study the distribution of the average revenue product of labor. In a frictionless world, the distribution of the marginal revenue product of labor and thus, using our model, the average revenue product of labor is degenerate. This is seen by the "no ac" row in Table 5. But frictions in labor adjustment change this distribution and its covariance with employment and profitability.

The other rows, including the baseline, do not have a zero standard deviation of $arpl_{it}$ 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" and "cl,sp" cases. Note too that this 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.

5.4 Dynamics

The analysis thus far compares 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 employment, 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 is the intervention that has the largest 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.[21]

We trace out the two paths of aggregate employment for 50 periods are shown in Figure 1. The series marked with a "+" comes from the introduction of higher severance pay at the baseline parameters. This is the "sp" experiment in Table 3. The series shown as a solid line combines the increase in severance payments with credit market liberalization. This is the "sp,cl" experiment in Table 3. The profitability shocks are the same for the two policy experiments.

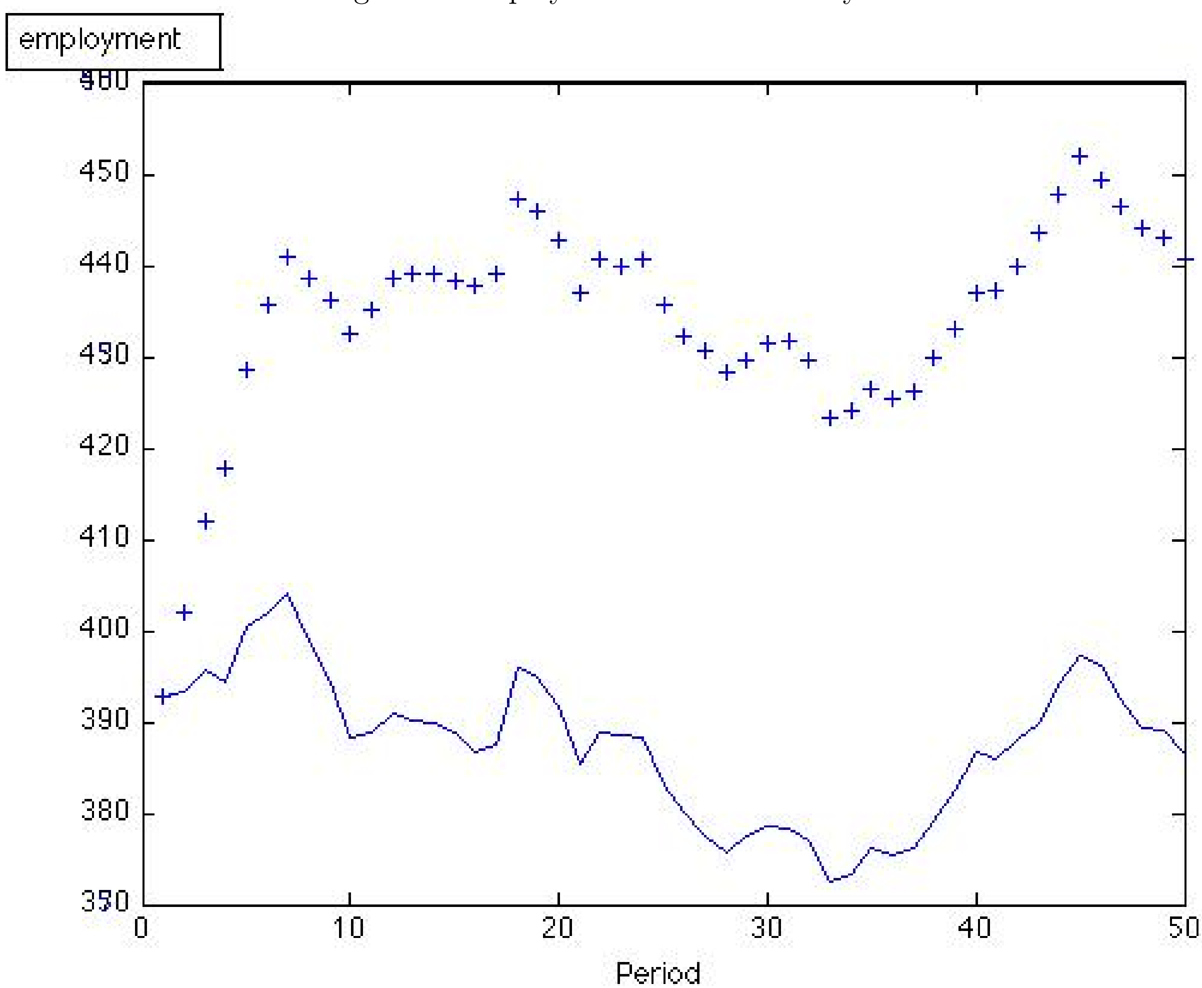
In the initial period, the policy is not in force and the average level of employment is about 390 workers in both cases. Aggregate employment is closer to 440 by the end of the simulation period for the "sp" experiment but remains around 390 in the "sp,cl" case.

For the "sp" case, the response to the policy in the first ten periods is striking. Employment grows rapidly. This is in part due to the high average shock but is mainly due to the impact of severance pay which increases the costs of firing. At the estimated discount factor, firm's getting positive profitability shocks respond more to the current positive gains of adding workers, discounting the higher future firing costs. Yet those firms with relatively low profitability do not fire due to the higher severance payments. Thus employment increases rapidly when the policy is first introduced. Between periods 20 and 40, average profitability is lower and employment falls slightly. But it recovers rapidly by period 45.

For the "sp,cl" experiment, the path of aggregate employment is quite different. The increase in the severance pay is balanced by the higher discount factor. Thus the dramatic increase in employment in the first few periods does not happen when the increased hiring costs are coupled with liberalization of capital markets.

[21] 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: Employment Transitional Dynamics



The series indicated with a "+" come from the "sp" experiment. The solid line is the "sp,cl" experiment.

5.5 Wage Responses

The analysis studies the policy interventions independently. Any changes in wages induced by the policy measures are excluded. This section introduces wage responses to the policy interventions.

The policy that had the most impact was the increase in severance pay. By construction, this increase in severance pay was not offset by any wage adjustments. Put differently, overall expected compensation to workers rose in this experiment.

An alternative scenario would have the base wage adjust so that workers expected compensation did not increase with this policy change. A simple contracting model illustrates the approach.[22]

Suppose that a plant has a pool of workers, each faces employment uncertainty. With probability $(1-\delta)$ the worker is employed and obtains expected utility of $Eu(\omega_0+\omega_1 h^\zeta - g(h))$ where $\omega_0+\omega_1 h^\zeta$ is the compensation schedule described earlier and $g(h)$ is the disutility for working h hours. At the time of contracting, the worker does not know the hours worked, hence the expectation.

A worker not getting a job will obtain utility of $u(\gamma\omega_0)$. Here γ is the fraction of the base wage provided through severance payments. This unemployment occurs with probability δ.

Suppose that under the contract, the worker is indifferent between working at this plant and getting another job or even returning to a rural sector, then we have: $(1-\delta)Eu(\omega_0+\omega_1 h^\zeta - g(h)) + \delta u(\gamma\omega_0) = \bar{U}$, where $\bar{U}$ is this outside alternative. If, and this is a critical assumption, the supply of workers is infinitely elastic at $\bar{U}$, then we can take this as given in the analysis.

All else the same, we are interested in how changes in severance pay lead to changes in the base wage. Using the indifference condition, the elasticity of base compensation to severance pay is:

$$\frac{d\omega_0/\omega_0}{d\gamma/\gamma} = \frac{-\delta\gamma u'(\gamma\omega_0)}{(1-\delta)Eu'(\omega_0+\omega_1 h^\zeta - g(h)) + \delta\gamma u'(\gamma\omega_0)} \tag{8}$$

This derivative is clearly negative, indicating the substitution of base wage payments for severance payments. It is also less than one in absolute value.

Given this, we can use our analysis of variations in the base wage to study the augmented effects of severance pay. To do so, suppose that severance pay equalize the expected marginal utilities of employment and unemployment workers. In that case, the elasticity simplifies to:

[22] In this contracting model, severance payments are optimal so that their imposition must come from the inability of the plant to commit to them *ex ante*.

$$\frac{d\omega_0/\omega_0}{d\gamma/\gamma} = -\frac{\delta\gamma}{1-\delta+\delta\gamma}. \tag{9}$$

Using our estimates of job destruction from Table 5 and the estimate of firing costs of about 1.5 months, we obtain $\frac{d\omega_0/\omega_0}{d\gamma/\gamma} = -\frac{0.065*(1.5/12)}{1-0.065+0.065*(1.5/12)} = -0.0085$.

Thus using our estimates, there would be a small wage decrease and, from the estimated unitary elasticity of labor demand, a small employment increase. This effect would be even smaller if risk sharing was imperfect so that $Eu'(\omega_0 + \omega_1 h^{\zeta} - g(h)) > u'(\gamma\omega_0)$.

6 Model and Parameter Sensitivity

Which model elements and parameters are most important for these policy results? In this section, we consider models which differ from the baseline specification. We also study how our results vary in the neighborhood of the baseline estimates. For both of these exercises, we focus on the effects of the policies on employment.

6.1 Alternative Models

Table 6 shows employment levels for various combinations of models (the rows) and policies (the columns). The models include (i) the baseline, (ii) the no adjustment cost case, *no ac* (iii) the credit liberalization model, *cl*, (iv) a model, *hiring*, with hiring rather than firing costs, (v) a model, *quad*, with large quadratic adjustment costs and (vi) a model, OLS α, with different parameters for the revenue function and the shocks. The Appendix presents the estimation for the hiring cost, quadratic adjustment cost and OLS α models used in these policy experiments.

The *cl* model uses the baseline parameters but sets $\beta = 0.95$, as in Table 3. The experiments reported below illustrate how credit liberalization interacts with other policy measures.

The OLS α experiment returns to the OLS estimated values of α and ρ reported in Table 2. In this experiment, the values of α and ρ are estimated within the dynamic programming problem to reproduce the OLS estimates.[23] For this case, if we solve the model at the estimated parameters, including $\alpha = 0.37$ and $\rho = 0.94$, we generate an OLS estimate of the curvature of the revenue

[23]The estimated values of the parameters are reported in Table 11 and the moments are provided in Table 12.

function in simulated data equal to 0.638 and a serial correlation of the residual of 0.824, both close to the OLS estimate in Table 2. The difference between $\alpha = 0.37$ and the OLS estimate of 0.638 comes from omitted variable bias.

Table 6: Employment Effects: Alternative Models

Model	baseline	fc	sp	he	cl	cl,sp	fc(10)	bw
baseline	389.38	390.05	436.93	384.86	369.33	383.70	388.97	313.11
no ac	456.92	454.89	426.68	450.16	456.92	378.48	456.92	370.83
cl	369.34	370.46	383.71	365.04	369.34	383.70	370.74	300.45
hiring	283.12	284.93	358.127	278.66	293.74	336.38	285.49	235.25
quad	369.14	372.57	449.74	353.58	371.26	375.27	372.94	300.08
OLS α	390.95	392.32	428.25	390.65	377.04	391.70	390.87	313.66

Table 6 exhibits the employment effects of different policies relative to the baseline. The issue is whether these effects are sensitive to the model.

Looking at the fc and $fc(10)$ policy interventions, it seems that the employment effects are small for all the models. Even in the quadratic adjustment cost model, the addition of this fixed cost has only a 1% change in employment. The *sp* intervention leads to a sizable employment increase for all the models. The effects of the credit market liberalization, *cl*, seems more model dependent.

The case of no adjustment costs is shown in the table as well. For that case, in contrast to the baseline, the increased severance payments lead to a fall in employment. From our experimentation, this result is again dependent on the discount factor. If the discount factor is reduced to 0.90 rather than the estimated value of 0.917, then the employment effect from increased severance payments in the frictionless case is essentially zero. When credit liberalization occurs at the same time as the increase in severance payments, the reduction in employment from the two policies is considerably larger than from the increase in severance payments alone.

The results for the OLS α case indicate that if we set α and ρ to match the OLS estimates from the data, the policy effects are similar to those from the baseline. That is, "sp" increases employment, "cl" reduces it and the elasticity of labor demand is around -1.

6.2 Parameter Sensitivity

It is also important to focus on which of the parameters are important for generating the effects of the policies on policy targets. For example, if there is interest in the effects of policies on employment, then it is useful to isolate the parameters that are most important for this policy goal.

To study this issue, we undertook small variations in parameters in the neighborhood of the baseline estimates. These parameter variations are summarized in Table 7. The rows indicate the parameter that is being varied while the columns give the full range of parameters used. So, for example, the row labeled ν and the one below give the two parameter vectors associated with the experiments of studying the employment effects of variations in ν around the estimated value of 0.013.

Table 7: Alternative Parameters and Policies

policy	ζ	ν	F^-	γ^-	β
ζ	2.1357	0.0125	0.0095	0.0129	0.9171
	2.1789	0.0125	0.0095	0.0129	0.9171
ν	2.1573	0.0063	0.0095	0.0129	0.9171
	2.1573	0.0188	0.0095	0.0129	0.9171
F^-	2.1573	0.0125	0.0047	0.0129	0.9171
	2.1573	0.0125	0.0142	0.0129	0.9171
γ^-	2.1573	0.0125	0.0095	0.0065	0.9171
	2.1573	0.0125	0.0095	0.0193	0.9171
β	2.1573	0.0125	0.0095	0.0129	0.9079
	2.1573	0.0125	0.0095	0.0129	0.9263

For each of the parameter vectors in Table 7, we simulated the model and studied the employment effects of the various policy measures. The results are summarized in Table 8.

In Table 8, the variations in parameters are the rows (the ones reported in Table 7) and the columns are the different policies. The entries are the mean employment levels for the combinations of parameters and policies. So, for example, the row labeled F^- and the one below it study the effects of variations in the estimated fixed cost on employment in the different experiments.[24]

Looking down one of the columns of the table gives some ideas about what parameters are important for the employment effects of the various policies. So, for example, looking at the

[24]For some of these, like the fc experiment when we vary F^-, we have to be careful since the policy experiment is itself dependent on the level of the variable.

severance pay (sp) experiment, β matters a lot for the employment effects while ζ matters relatively little.

In general we see that regardless of the policy, the employment effects of the intervention depend mainly on γ^- and β. The other parameters, while important for matching the moments, seem relatively unimportant for judging the effects of these interventions on employment.

From Table 3, we see that the standard errors for these parameter estimates are quite small. Further, given the importance of β, we know from experimentation that the value of the model fit, given in (6), is very sensitive to variations in this parameter.

Table 8: Employment Effects: Alternative Parameters

parameter	baseline	fc	sp	he	cl	cl,sp	fc(10)	bw
ζ	389.7	390.9	437.3	385.3	369.7	384.0	390.0	313.4
	388.3	389.6	436.6	384.5	369.1	382.8	388.7	312.8
ν	388.7	390.0	429.8	384.4	369.8	378.9	389.3	314.5
	390.1	391.6	441.8	385.8	370.4	386.5	390.6	313.1
F^-	388.6	389.4	435.9	384.1	368.8	383.1	388.7	312.6
	389.9	391.3	437.8	385.5	370.0	383.4	389.7	313.6
γ^-	380.7	381.9	389.4	376.5	372.3	369.3	380.9	310.2
	407.7	409.3	551.5	403.0	373.3	420.1	407.4	321.9
β	394.8	396.1	455.2	390.4	369.3	383.7	395.1	316.9
	383.4	384.6	420.5	379.0	369.3	383.7	383.8	309.7

7 Exit

Thus far we have focused the estimation on a balanced panel. Accordingly, the policy analysis assumes that plants continue in operation: there is no exit option. Yet in response to an adverse shock, a plant might be induced to exit. This response is enlarged by policies which introduce larger firing costs.

In our data, the exit rates are about 11%. That is, averaging over the three years of our panel, about 11% of the plants producing in year t were not producing in year $t+1$. As is common in panel studies, there may be measurement problems that lead to a plant as being mis-classified as exiting. For example, a merger may lead to a plant being classified as having exited and perhaps a new entry recorded as well. Or, as in our study, a plant may have its revenue fall below the critical level and thus no longer be included in the sample. These issues are discussed at some length in Deng, Haltiwanger, McGuckin, Xu, Liu, and Liu (December 2007).

We first discuss how we amend the model to include exit. We then talk about estimation and finally some differences in the policy experiments.

7.1 Adding Exit to the Model

Modeling exit requires the addition of a fixed operating expense. The value of a continuing plant is given by:

$$V^c(A, e_{-1}) = \max_{h,e} R(A, e, h) - \omega(e, h) - C\left(A, e_{-1}, e\right) - \Gamma + \beta E_{A'|A} V(A', e) \tag{10}$$

for all (A, e_{-1}). Here the fixed cost is Γ.

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.[25]

$$V(A, e_{-1}) = \max\{V^c(A, e_{-1}), 0\}. \tag{11}$$

For a given set of parameters, including Γ, the model is again solved using value function iteration. The decision rules involve choices on the intensive margin regarding hires and hours worked as well as a choice of the extensive margin to exit or not.

7.2 Estimates with Exit

Once exit is introduced, the estimation strategy must be amended in a few ways. First, we estimate the parameters of the revenue function from an unbalanced panel. The parameter estimates using the Levinsohn-Petrin approach are quite close to those reported in Table 2: $\alpha = 0.2042, \rho = 0.9002$. Interestingly, in contrast to the findings in Olley and Pakes (1996), the selection effect from looking at continuing plants in balanced panel, does not appear to matter for our estimation.

Second, we need to add a moment to allow us to estimate Γ. As noted earlier, the exit rate of around 11% is probably a bit too high. Accordingly, we target a rate of 10.5% as well as a lower

[25] Thanks to Immo Schott for bringing this issue to our attention.

exit rate of 7.5%.

The estimated parameters are reported in the rows of Table 11 labeled "exit low" and "exit high" respectively. To retain comparison with the baseline, this estimates were obtained iteratively. We fixed Γ to match the exit rate and then estimated the remaining parameters to fit the same moments that were matched in the baseline estimates. We then iterated this procedure to fit the exit low target of around 7.5% and the high exit rate target of around 10.5%. Since the moments came from a balanced panel, the procedure selected a balanced panel from the unbalanced panel created by introducing exit into the analysis.

The moment predictions for the estimated models are shown in Table 12. With the two possible exit moments, we estimate a fixed operation cost of 42% of average revenue to generate an exit rate of 7.68% and a fixed cost of 51% of average revenue to generate an exit rate of 10.8%.

In terms of parameters, the estimates are not too far from the baseline. But the estimated cost of hours variation, ζ, is larger and the linear firing costs are lower. Also the discount factors estimated are higher and closer to the traditionally assumed 0.95 annual value. The discount factor here is partly identified from the decision to continue in operation.

7.3 Policy Implications: Exit Margin

Table 9 shows the interaction of the policy measures and exit. The policies described above are represented as the columns of the table. The rows indicate the average level of employment, the exit rate and job destruction due to exit under the two parameterizations associated with a low and a high exit rate. Here the job destruction due to exit is the fraction of employment in period $t-1$ represented by the plants that exited in period t. Note that these are averages not the immediate response of the economy to the introduction of a job protection policy.

Once again, the policy matters most on the extensive margin is the increase in severance pay. For both the low and high exit rate specifications, the "sp" experiment creates significant employment gains. The exit rates are also higher in this case.

Interestingly, on the extensive margin credit market liberalization reduces exit. This make sense: with a higher discount factor, gains to remaining in the market once profitability returns are discounted less and so plants are more likely to remain active. But again, the average plant size is considerable lower than the baseline.

Also, the response of employment to an increase in the base wage is about the same in the model with exit as in the baseline experiment. The action in employment seems to be more on the intensive than the extensive margin as the exit rates do not respond to the increase in the base wage.

Table 9: Exit Effects: Alternative Policies

variable	baseline	fc	sp	he	cl	cl,sp	bw
			Low Exit Rate				
employment	605.799	608.162	970.492	496.316	508.722	602.137	481.31
exit rate	0.077	0.077	0.087	0.078	0.051	0.060	0.077
JD rate, exit	0.019	0.020	0.031	0.021	0.010	0.022	0.017
			High Exit Rate				
employment	744.206	751.720	1375.852	615.256	711.294	1261.247	580.69
exit rate	0.108	0.109	0.132	0.117	0.106	0.124	0.110
JD rate, exit	0.028	0.028	0.026	0.031	0.028	0.028	0.028

8 Conclusion

This paper studies the effects of labor market policies in China on the employment and productivity of private plants. Using a model of dynamic labor demand estimated from moments prior to the introduction of policy measures, we characterize the impact of these new labor regulations. We do this for our baseline estimated model and for other parameterizations to gauge the robustness of our findings.

There a couple of findings that seem robust across parameterizations. First the policy of increased severance payments has the largest impact on employment and productivity. Since we estimate a relatively low discount factor, the increase in severance pay leads to an increase in employment. This policy also leads to a higher covariance between productivity 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 employment once plants discount less heavily future firing costs. The employment increase from a severance pay increase is

Table 10: Characteristics of Plants by type, 2005-2007 balanced panel.

	All	Trimmed	Domestic	Foreign
# plants	156,185	148,390	120,719	35,466
Value added (VA)	24,228	17,665	18,146	44,931
	(147,014)	(53,062)	(96,231)	(251,206)
Revenue (Rev.)	92,074	64,290	66,417	179,407
	(712,869)	(205,842)	(356,131)	(1,340,289)
Employment (Emp.)	224	172	180	385
	(751)	(190)	(569)	(1,186)
Capital (Cap.)	21,752	15,397	15,362	43,502
	(153,506)	(69,207)	(124,991)	(223,570)
Cap./Emp.	92	88	80	136
	(636)	(430)	(422)	(1,108)
VA/Emp.	133	127	127	155
	(376)	(309)	(277)	(613)
VA/Cap.	5.5	5.3	5.6	5.3
	(92)	(89)	(80)	(125)
Rev./Emp.	487	461	467	561
	(1,166)	(1,18)	(934)	(1,769)
Rev./Cap.	23.2	22.2	24.1	20.2
	(319)	(312)	(332)	(267)

All monetary terms are in 1,000 RMB, deflated to 2005 level. The trimmed sample excludes the upper and lower 2.5% tails by employment size. Standard deviations are parenthesized.

reduced when this policy is combined with credit market liberalization.

Finally, the elasticity of labor demand with respect to variations in the base wage is -1 in the estimated model without exit, and is very robust across specifications and parameterizations. This response is larger when exit is allowed.

9 Appendix

9.1 Data

Table 10 summarizes capital, employment (number of workers employed), revenue, and value-added by enterprise type for the 2005-2007 period. All monetary terms are deflated to thousand Yuan in 2005 using CPI. Capital (plant and equipment) is calculated by the book value of fixed capital net of depreciation. Hours information is not available.

Table 11: Parameters Estimates

model	ζ	ν	F^+	F^-	γ^+	γ^-	λ^+	λ^-	β
baseline	2.157	0.013	0.000	0.009	0.000	0.013	1	1	0.917
firing	2.157	0.013	0.000	0.009	0.000	0.013	1	1	0.917
firing ($x = 0$)	2.430	0.017	0.000	0.000	0.000	0.015	1	1	0.935
hiring	2.935	0.024	0.000	0.000	0.020	0.000	1	1	0.956
oc	3.114	0.515	0	0	0.000	0.158	0.998	0.998	0.982
quad	3.07	0.038	0	0	0	0	1	1	0.894
OLS α	1.408	0.051	0.000	0.009	0.000	0.053	1	1	0.928
exit rate low	2.80	0.002	0.0	0.012	0.0	0.008	1	1	0.923
exit rate high	2.836	0.002	0.000	0.013	0.000	0.007	1	1	0.938

Here: (i) baseline are the baseline estimates, (ii) firing allows just firing and quadratic adjustment costs, (iii) firing $x = 0$ forces the fixed firing costs to apply to all job destruction, (iv) hiring allows just hiring and quadratic adjustment costs and (v) oc is the case of opportunity costs, (vi) quad allows just quadratic adjustment costs. An entry with either a 0 or a 1 indicates a parameter that was set, not estimated.

The column called "trimmed" is a subsample in which the top and bottom 2.5% of the plants, by employment size, are removed to deal with outliers. This subsample is used in the estimation.

9.2 Estimation Results

The estimation results for a variety of specifications are shown in Tables 11 and 12. Table 11 shows the estimated parameter values for models other than the baseline. The baseline allows for both hiring and firing fixed and linear costs. The model in the second row, labeled firing, allows only firing costs. This is essentially the same as the baseline: hiring costs were not relevant. The row labeled firing (x=0) estimates the baseline specification when the fixed cost of firing applies to all job destruction, not just job destruction in excess of 20%. In this case, compared to the baseline, the estimated fixed cost is zero and the linear firing cost is a bit larger. The next row is the model with just hiring costs. The row labeled oc is the case of opportunity cost where the nonconvexity is due to lost revenue when employment is adjusted as (λ^+, λ^-) are allowed to be less than one. The "quad" model is the quadratic adjustment cost alone. Next is the OLS α experiment in which the values of α and ρ were determined by matching the OLS regression results from simulated data from the OLS results from actual data reported in Table 2. The final two cases are the exit rate models.

Table 12: Moments for plants

	std(r/e)	sc	JC30	JC1020	JC10	inaction	JD10	JD1020	JD30	fit/1000
Data	0.975	0.922	0.151	0.073	0.119	0.37	0.101	0.051	0.056	na
baseline	0.939	0.975	0.100	0.075	0.124	0.406	0.071	0.058	0.058	9.272
firing	0.939	0.975	0.100	0.075	0.124	0.406	0.071	0.058	0.058	9.275
firing ($x = 0$)	0.961	0.977	0.090	0.076	0.125	0.411	0.078	0.064	0.061	9.779
hiring	0.955	0.977	0.089	0.081	0.123	0.406	0.079	0.065	0.060	9.866
oc	0.969	0.983	0.047	0.096	0.113	0.385	0.121	0.090	0.025	19.81
quad	0.883	0.977	0.10	0.168	0.19	0.024	0.13	0.125	0.076	82.02
OLS α	0.934	0.974	0.106	0.075	0.120	0.412	0.071	0.058	0.056	8.523
exit rate low	1.023	0.898	0.184	0.062	0.105	0.356	0.048	0.055	0.088	9.44
exit rate high	1.121	0.893	0.150	0.053	0.097	0.389	0.077	0.060	0.078	10.63

In this table, std(r/e) is the standard deviation of the log of revenue per worker, sc is the serial correlation in 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 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.

Table 12 reports the moments for these alternative models. As indicated in the last column of the table, the fit is not as good for these alternatives except for the OLS α case, which is slightly better than the baseline for the moments reported in Table 12.[26]

9.3 Identification

The matrix in Table 13 shows how changes in parameters (the columns) influence the moments (the rows). This matrix provides information on how each of the parameters is identified. So, for example, variations in β have large effects on the relative standard deviation and also on the inaction rate. The moments are relatively sensitive to variations in the parameters. These derivatives underlie the computation of the standard errors for the baseline parameter estimates.

[26] A more complete comparison of the models would require the additional of the OLS estimate of α and the corresponding value of ρ to the estimation.

Table 13: Sensitivity of Moments to Parameter Variations

Moment	ζ	ν	F^-	γ^-	β
std(r/e)	-0.2068	14.0518	1.2451	18.8376	-0.8314
sc	-0.0065	1.0088	0.0069	0.6635	-0.0586
JC30	0.0181	-3.3266	-0.0608	-4.6911	0.2044
JC1020	-0.0161	1.9025	-0.1389	-3.4237	0.1923
JC10	0.2269	1.8659	0.0380	-2.9243	0.1189
inaction	-0.1637	-6.0034	-0.4453	21.6798	-0.5789
JD10	-0.0821	1.7722	0.0297	-1.3934	0.0734
JD1020	0.0218	2.2597	-0.1026	-1.6540	-0.0158
JD30	0.0154	-0.8687	-1.3457	-3.0935	0.0737

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