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Abstract

In January 2008, China imposed a new labour contract law. This new law is the most significant reform to the law of employment relations in mainland China in more than a decade. The paper provides a theoretical framework on the inter-linkages between labour market regulation, option value and the choice and timing of employment. All in all, the paper demonstrates that the Labour Contract Law in it´s own right will have only small impacts upon employment in the fast-growing Chinese economy. On the contrary, induced increasing unit labour costs represent the real issue and may reduce employment.

Keywords: China, Labour Contract Law, Real Options, Employment
JEL-Classification: C61, D81, D92, J23

1. Introduction

Although China has made awe-inspiring progress in economic development and growth, it is facing formidable employment challenges while transforming toward a knowledge and service-based economy and further opening up to international competition after its WTO accession. One of the biggest challenges during transition is how to create 100-300 million new jobs in the coming decade to absorb the millions of laid-off workers, rural migrant workers and newly added labour force.

Furthermore, it is quite obvious that Chinese workers and their families have lost the job security and social welfare that they enjoyed for decades before the Reform Era. It may not have been much, but it was a safety net. That has gone. This is one of the root causes of the kind of protests which have developed in China, extreme social insecurity.[1] As a response to this, the government has announced that it wants to bring in policies aimed at restoring a more harmonious society. There is an apparent shift in government perception that that something has to be done. China´s new Labour Contract Law which became effective on 1 January 2008 can be considered as being part of this attempt to grapple with this issue.[2]

The new Labour Contract Law has stirred up a great deal of controversy among economists and has raised concerns about the sustainability of China´s economic growth. The opponents of reform have gone so far as to threaten a flight of capital if these changes become law.[3] They view the law as the twilight of the age of cheap labour in China, undermining the country's most prized comparative advantage. Using more moderate language, the American Chamber of Commerce in China has filed lengthy objections to the reforms with the legislature, insisting that the improvements designed to protect workers from casualisation and arbitrary firings will raise costs for employers by raising requirements for severance pay. The worry is that the new Labour Contract Law will adversely impact the country's economy at a time when export-oriented enterprises, especially labour-intensive firms, already encounter increasing difficulties in operation, due to factors such as the renminbi appreciation, the rise of wages and production costs and declining demand for Chinese products worldwide. Despite this ongoing contention and dispute, the new regulation has so far been absent from economic research radar screens.

[1] Over the last few years, disputes over the widespread employer practice of failing to pay wages due and owing on time and in full, low wages, forced overtime for little or no additional pay, unsafe working conditions and the lack of benefits, have all developed into mass protests. Furthermore, land disputes are exploding both in urban and rural areas as local governments in pursuit of economic growth requisition land for developers, often raising issues of corruption and collusion.

[2] The way of translating the law, *the Zhonghua Renmin Gongheguo Laodong Hetong Fa* (in Mandarin) differs. This article uses the expression "Labour Contract Law".

[3] Several observers have suggested that the provisions of the new law will potentially have wide-reaching ramifications for firms in China (http://www.economist.com/business/displaystory.cfm?story_id=9546386).

Against this background, this paper looks at the transmission from structural reforms in labour markets to employment outcomes.[4] Its main contribution is the use of a real options framework to identify employment effects. While it is certainly not a pioneer in applying a real option model to labour demand, it is to our knowledge the first to formalize the new Chinese policy framework and to investigate its dynamics.

The central question posed in this paper is whether China´s new Labour Contract Law has affected labour demand and employment. Despite a large volume of research, much controversy remains over the impact of employment protection legislation on labour market performance. Employment protection serves a useful purpose in securing workers against job loss.[5] However, serious concerns remain about the potential negative impact of stringent statutory employment protection. On balance, the evidence suggests that stringent employment protection legislation is associated with lower employment levels, but some commentators also have strong suspicions that it leads to higher structural unemployment. On the other hand, it is reasonably well established that employment protection reduces turnover in and out of unemployment. Moreover, employment protection legislation may strengthen the hand of insiders in wage bargaining, adversely affecting the wage setting schedule and employment outcome.[6]

The paper is organised as follows. The purpose of Section 2 is to review the main ingredients of the new Chinese Labour Contract Law. Section 3 presents the theoretical framework providing a nexus between labour market regulation and employment. Section 4 illustrates the potential impacts of the new legal framework using model simulations for different scenarios. This allows to develop a "feel" for the model and to "draw a map" of the factor demand sensitivity to various structural characteristics of the environment in which Chinese firms operate. Section 5 provides some concluding remarks. Two appendices at the end of the paper collect some proofs and technical derivations which are rather involved. Readers who are not interested in the nuts and bolts of the derivations, can skip the appendices without losing the main argument of the paper.

2. The New Chinese Labour Contract Law

The Labour Contract Law was enacted by the Standing Committee of the National People's Congress on 29 June 2007 and became effective on 1 January 2008.[7] The purposes of the new Labour Contract Law are to perfect the labour contract system, clarify the rights and obligations of

[4] For an overview discussion of the relationship between labour market institutions and economic performance in terms of unemployment and growth, see Nickell and Layard (1999).

[5] The model below deals with employment protection and labour demand. It is well-known that employment protection can be justified on the grounds that workers are risk averse and that they do not have the possibility to privately insure themselves unemployment [see Bertola (2004)].

[6] See Addison and Teixera (2003) for a survey of the literature.

[7] An excellent survey of the reasons for the enactment and the content of the Labour Contract Law is available in Cooney et al. (2007). A translation is available at http://en.wikipedia.org/wiki/China_Employment_Law.

the parties, protect employees´ lawful interests and establish or strengthen stable labour relations.[8] Written labour contracts are the mechanism for doing so.[9]

Other provisions will, however, place more burdens on employers in general, including pressure to engage in collective bargaining over many issues and to consult workers on work-related issues including compensation, work hours, leave, occupational safety and health, insurance and fringe benefits, training, discipline and performance norms. The requirement to listen to the unions´ opinions strengthens the say of labour in business decisions. Some companies responded by forming in-house workers´ groups, but the All-China Federation of Trade Unions (*ACFTU*) objected, claiming that this amounted to the creation of an alternative labour union, and is thus illegal. Instead the *ACFTU* has used the new law as the basis for a huge registration drive and unrelenting pressure is applied to firms to sign up with the government-affiliated monopoly union. The stated goal is to have unions in all of China´s private firms by 2010.[10]

The basic rules of employment relationships are also changed in several important respects. Probationary periods for new workers are shortened to a maximum of two months (one month for employment terms of less than a year) from the current six months, unless the term is at least three years or without a fixed term, in which case six months is permissible - and the minimum salary during the probationary period is 80 percent of the starting salary for regular workers in the same position. Non-compete provisions restricting an employee's post-employment options remain legally compliant, but the maximum term is two years - one year shorter than the three years now generally allowed in China - and they are restricted to senior managers, senior technical personnel and other personnel with confidentiality obligations.

Employers contemplating a reduction in force of 20 or more employees or 10 percent or more of the workforce are allowed to do so in the context of a bankruptcy restructuring, severe production difficulties or change of production, technology or business form, but must give the union or all workers at least 30 days' advance notice. Mass firings because of labour problems are therefore impermissible.

Among the biggest changes are new termination provisions. Business associations sought to reduce firing costs, whereas unions pushed for job security and compensation in the event of dismissals. The previous labour law had allowed workers to be hired in a series of fixed-term contracts, thereby

[8] The legislation was finalised parallel to the public furore in June 2007 over slave labour conditions in the brick industry in the province of Shanxi. The investigations revealed that rural migrant workers, many of them teenagers, were being kidnapped, sold to brick factories operating without licenses and forced to work up to 18 hours a day for no pay.

[9] Written contracts have already been required under the previous labour contract law (1994) , but this requirement was often disregarded, particularly in casual employment industries like construction, where migrant workers have often been mistreated and deprived of promised compensation. Party-run courts often fail to enforce their legal rights.

[10] For example, in a reflection of just how difficult business conditions are in China, Walmart has recently signed a collective-bargaining agreement with the *ACFTU*. By contrast, firms that resist will be blacklisted and face the risk of being subject to endless audits, tax examinations and accusations of employment contract law violations.

allowing either party to terminate an employment relationship without penalty or severance pay by simply letting the contract expire. One key provision of the new Labour Contract Law is that workers who have been employed at the same enterprise for 10 years or more will be legally entitled to an "open-ended" labour contract, which should guarantee them adequate financial compensation should they be made redundant (one month of base salary per year of employment up to a maximum of 12 months for 12 years).[11] Where severance is payable, it is based on the employee's income for the 12-month period immediately preceding the date of termination (and "income" includes base salary, bonus, subsidy, allowance, commission, etc., paid to the worker).

Under the new Labour Contract Law, the maximum number of fixed-term contracts is two. Afterwards the fixed-term contract is subject to a conversion requirement. Employees who have at least 15 consecutive years of service and who are within five years of retirement age (60 for men, 55 for women in general; five years younger in physical occupations) are protected from termination because of a deterioration in capability or a reduction in force by the employer. Temporary employees paid on an hourly basis will be treated as regular employees if they work more than 24 hours a week. Finally, the new Labour Contract Law offers another pathway from temporary to permanent work. Chinese companies often employ a large number of temporary workers hired through temporary work agencies. Temporary work encourages management to avoid the protections and commitment that come with standard employment. Under the new law, temporary work agency workers would become permanent employees after one year of employment at a client firm, thus reducing the number of insecure, contingent jobs.

Having described the new Chinese labour regulations, we next model the behaviour of private firms.[12] We are interested in the way in which firms adapt their behaviour to the constraints of labour regulations and whether the new Chinese Labour Contract Law is an obstacle to employment.

3. Setting the Stage: Modelling Firms´ Behaviour

Recent theoretical analyses of factor demand under uncertainty have highlighted the effects of irreversibility in generating "real options". In these models the interaction of time-varying

[11] Several employers have panicked on learning of the unlimited labour contract provision and have seeked loopholes in the new Labour Contract Law. The most noted example of this tactic was the move by Huawei - the former state-owned enterprise and now privately owned telecommunications conglomerate based in Shenzhen - to persuade about 7,000 employees who had been with the company for more than eight years to resign. In return, the employees received a lump sum of one month's salary for every year of employment, plus one additional month's salary, and were allowed to rejoin the company on a short-term contract. The generosity of the provision may be explained in part by the inadequacy of government-provided unemployment benefits in China.

[12] Chinese industry comprises a number of different forms of firms ranging from foreign companies to state owned enterprises. The degree to which these might approximate a competitive firm presumably varies with the type of organization. One should be aware that state-owned firms may show less concern for employment regulations than those completely private. Larger employment adjustments in state-owned firms often involve generous packages transferring, at least partially, the adjustment costs to taxpayers.

uncertainty and irreversibility leads to a range of inaction where factor demand is zero as the firm prefers to "wait and see" rather than undertaking a costly action with uncertain consequences. Indeed, waiting allows firms to gather new information on the uncertain future. Below we therefore develop a real options model with a rich specification of adjustment costs. Applying the real option theory to the case of labour demand derives from the fact that hiring and/or firing decisions are rarely now-or-never decisions. In most cases, it is feasible to delay action and wait for new information.[13] Empirical counterparts to the variables outlined in this section are discussed in Section 4.[14] It is assumed that a represented firm has the following Cobb-Douglas production function

$$(1) \qquad Y = \Lambda K^{\alpha} L^{1-\alpha}, \; 0 < \alpha < 1,$$

where Y denotes real output, α is the distribution parameters, L is the number of employees subject to changes due to hiring, firing and/or natural attrition, and K is the constant level of the capital stock, and Λ is the labour productivity growing at a rate of η_{Λ}.[15] We further assume that the firm faces an isoelastic demand function

$$(2) \qquad p = Y^{(1-\psi)/\psi} Z, \; \psi \geq 1$$

where p represents the price, Z denotes the demand shock, and ψ is an elasticity parameter that takes its minimum value of 1 under perfect competition [see Abel and Eberly (1994)]. Therefore, current profits, measured in units of output, are defined as

$$(3) \qquad \Pi = Z\Lambda^{\frac{1}{\psi}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}} - w(1+\tau)L - C(I),$$

[13] Although an established literature exists on labour demand under uncertainty using real options models, this is not true for the transition economies. The approach tentatively adopted here is therefore to draw upon the former while considering certain modifications to allow for Chinese realities.

[14] In this paper we consider labour market regulations as given, treating them as exogenous. On the contrary, a new branch of research treats regulations as endogenous and attempts to understand better their formation. One view is that regulations are shaped by the political power of political groups [Acemoglu et al. (2005)]. Hence specific regulations are developed to facilitate the appropriation of existing rents by certain groups. The second view is that regulations are rent-creating institutions arising from redistributive conflicts [Saint-Paul (2000)].

[15] For the sake of simplicity we have used a Cobb-Douglas production function restricting the elasticity of substitution to unity. For a real options model with a constant elasticity of substitution (CES) production function, see Chen and Funke (2004). Note that the production function methodology assumes that firms operate on the production frontier, whereas in reality Chinese firms may be operating below the production frontier during transition.

where real wage, *w*, is assumed to grow deterministically at a constant rate η_w, τ denotes non-wage labour costs, and *I* represents gross changes of employment due to hiring and hiring – positive *I* denotes hiring and negative *I* firing – and *C* denotes the total costs of hiring and firing, consisting of a fixed and variable component

$$C(I_t) = \begin{cases} c_h + p_h I_t + \frac{1}{2}\gamma_h I_t^2 & \text{for } I_t > 0, \\ 0 & \text{for } I_t = 0, \\ c_f - p_f I_t + \frac{1}{2}\gamma_f I_t^2 & \text{for } I_t < 0. \end{cases} \tag{4}$$

When the firm hires (fires) workers, it pays a fixed cost c_h (c_f) and positive unit costs of hiring (firing) which may be rising in the number of workers hired (fired), $p_hI+1/2\gamma_hI^2$ (or $-p_fI+1/2\gamma_fI^2$), respectively. Note that $-p_fI > 0$ for firing since $I < 0$ in this case. The coefficients $c_{h/f}$ denote the fixed costs whenever the firm decides to hire or fire; the fixed costs are usually related to advertising, the screening process, and so on; the fixed costs for firing are related to legal consultations, disputes about firing, and the trade union's cooperativeness. The parameters p_h and p_f refer the unit costs of hiring and firing respectively. The parameters γ_h and γ_f regulate the extent of more or less speedier employment adjustment due to hiring and firing regulations. All parameters in equation (4) are positive.[16] The net employment changes over time for the firm are denoted by hiring/firing minus quits

$$\frac{dL_t}{ds} = I_t - \lambda L_t, \tag{5}$$

where λ denotes the constant quit rate per unit time. The representative risk-neutral firm maximises its discounted flow of profits

$$V = \max_I E\left[\int_0^\infty \left[Z_t \Lambda_t^{\frac{1}{\psi}} K^{\frac{\alpha}{\psi}} L_t^{\frac{1-\alpha}{\psi}} - w_t(1+\tau)L_t - C(I_t) \right] e^{-rt} dt \,\middle|\, Z_0 = Z, L_0 = L, \Lambda_0 = \Lambda, w_0 = w \right], \tag{6}$$

where $E[\cdot]$ denotes the expectation operator given the information set available to the firm at period $t = 0$, and r is the constant required rate of return. The intertemporal objective function implies that

[16] Following the standard modelling approach, we assume that other factors can be instantaneously and costlessly adjusted. Optimal stopping models with interrelated factor demand decisions are analysed in Chen and Funke (2008), Eberly and van Mieghem (1997) and Dixit (1997).

firms form expectations and beliefs on the future behaviour of the driving economic variables, which cannot be predicted with certainty. The modelling framework has to account for this challenge and has to formalise this issue in a coherent framework. This notion is formalised by assuming that the stochastic demand factor *Z* follows a geometric Brownian motion

$$dZ_t = \eta Z_t dt + \sigma Z_t dW_t, \tag{7}$$

where W is a Wiener process, $dW_t = \varepsilon_t \sqrt{dt}$ (since ε_t is a normally distributed random variable with mean zero and a standard deviation of unity with no serial correlation due to the assumption of independent increments of the Wiener process), η is the drift term and σ is the variance parameter. Using Itô´s Lemma, the Bellman equation for the value *V* at time zero is

$$rV = \max_I \left\{ Z\Lambda^{\frac{1}{\Lambda}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}} - w(1+\tau)L - C(I) + V_L(I - \lambda L) + \eta_w w V_w + \eta_\Lambda \Lambda V_\Lambda + \eta Z V_Z + \frac{1}{2}\sigma^2 Z^2 V_{ZZ} \right\}. \tag{8}$$

The first three terms in the square bracket represent the firm's immediate profits at *t* = 0 after deducting the total wage bill and costs related to hiring and firing; the fourth term shows changes in the value of the firm due to fluctuations in *L* due to quitting or hiring/firing; the fifth and sixth terms denote the impacts of changes in *w* and Λ on *V* over time; and the final two terms show the effect of changes in *Z* on the value of *V*.

The representive firm decides the optiomal condition of hiring or firing. The boundary conditions for hiring and firing for equation (8) can be summarised by the following two equations (see Appendix *A*):

$$v = H = p_h + \sqrt{2c_h\gamma_h} \quad \text{for hiring thresholds,} \tag{9}$$

and

$$v = -F = -\left(p_f + \sqrt{2c_f\gamma_f}\right) \text{ for firing thresholds,} \tag{10}$$

where *H* denotes the *effective* hiring-cost threshold, depending on the fixed costs, unit costs and adjustment speed costs parameters of hiring; *F* is the *effective* firing-cost threshold; and $v = V_L$ is the marginal inter-temporal value of profits with respect to workers. In the inaction area where $-F < v < H$ the firm does nothing and the number of employees only falls due to quits. The

magnitudes of *H* and *F* are positive functions of fixed costs $(c_{h/f})$, unit costs of hiring and firing $(p_{h/f})$ and the adjustment costs $(\gamma_{h/f})$. At the hiring (firing) thresholds, the firm would hire (fire) the following number of workers (see Appendix *A* for derivation),

(11) $I = \sqrt{2c_h/\gamma_h}$ for hiring;

(12) $I = -\sqrt{2c_f/\gamma_f}$ for firing.

As fixed costs increase, the firm chooses to hire/fire more employees so that total benefits of hiring/firing outweighs the total cost. With lower values of $\gamma_{h/f}$ the firm would also hire/fire more workers. The inaction area is smaller for lower $c_{h/f}$ and $\gamma_{h/f}$ since the firm needs to pay lower fixed and adjustment costs for the same numbers of hires/fires.[17] The marginal intertemporal values of employees for the boundary conditions of hiring and firing, *v*, in equations (9) and (10) are subject to the following partial differential equation, as shown in Appendix *A*

$$(13)\qquad (r+\lambda)v = \frac{1-\alpha}{\psi} Z\Lambda^{\frac{1}{\Lambda}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}-1} - w(1+\tau) - \lambda L v_L + \eta_w w v_w + \eta_\Lambda \Lambda v_\Lambda + \eta Z v_Z + \frac{1}{2}\sigma^2 Z^2 v_{ZZ},$$

where $v = V_L$, $v_Z = V_{LZ}$, $v_{ZZ} = V_{LZZ}$, $v_L = V_{LL}$, $v_\Lambda = V_{L\Lambda}$, and $v_w = V_{Lw}$. The solution for $v(Z)$ consists of the particular solutions and the homogenous solutions. The particular solutions, can be obtained from the direct integration of the following particular integral without considering hiring and firing

$$(14)\qquad v^P(Z) = E\left[\int_0^\infty \left[\frac{1-\alpha}{\psi} Z_s \Lambda_s^{\frac{1}{\Lambda}} K^{\frac{\alpha}{\psi}} L_s^{\frac{1-\alpha}{\psi}-1} - w_s(1+\tau)\right] e^{-(r+\lambda)s} ds\right].$$

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[17] Note that with null fixed costs and adjustment costs, equations (9) and (10) are reduced to the same forms as in Bentolila and Bertola (1990). Their implicit assumption is that the intertemporal value of marginal employees, *v*, never deviates outside of the inaction area of

$$v = \pm p_{h/f}.$$

Very small values of $\gamma_{h/f}$ guarantees that the firm can hire/fire a lot of employees [according to equations (5) and (11)]

$$dL/dt = I - \delta N \Rightarrow \Delta I = \left(\pm\sqrt{2c_{h/f}/\gamma_{h/f}} + \delta L\right)\Delta t.$$

This makes *v* fall back into the inaction area of

$$v = \pm p_{h/f}$$

immediately for any given shocks for very small values of $\gamma_{h/f}$.

After integration, we obtain the particular solutions

$$(15) \qquad v^P(Z) = \frac{\frac{1-\alpha}{\psi} Z\Lambda^{\frac{1}{\Lambda}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}-1}}{r + \frac{\lambda(1-\alpha)}{\psi} - \eta - \frac{\eta_\Lambda}{\psi}} - \frac{w(1+\tau)}{r+\lambda-\eta_w}.$$

The homogenous solutions, often representing the options to hire and fire, can be obtained from the homogenous part of equation (15). Letting v^G be the value of the option, the general solutions for the hiring and firing options (v_H^G and v_F^G) have the following forms, respectively (see Appendix *B* for details):

$$(16) \qquad v_H^G(Z) = A_1 \left(Z\Lambda^{\frac{1}{\Lambda}} L^{\frac{1-\alpha}{\psi}-1} \right)^{\beta_1}$$

and

$$(17) \qquad v_F^G(Z) = A_2 \left(Z\Lambda^{\frac{1}{\Lambda}} L^{\frac{1-\alpha}{\psi}-1} \right)^{\beta_2},$$

where β_1 and β_2 are the positive and negative roots of the characteristic equation

$$(18) \qquad \frac{1}{2}\sigma^2\beta(\beta-1) + \eta\beta + \frac{\eta_\Lambda}{\psi} - \frac{1-\alpha}{\psi}\lambda\beta - r = 0.$$

To satisfy the boundary conditions for hiring and firing that $v_H^G(0) = 0$ and $v_F^G(\infty) = 0$, we use the positive solution for v_H^G and the negative solution for v_F^G.

When there are effective costs of either hiring or firing as shown in (9) or (10), the firm will consider the option value of maintaining her current position against the alternative of hiring or firing. In other words, it should be evident that the hiring and firing policy of the optimising firm is discontinuous. In some periods the optimal strategy of the firm will be to adjust the number of

workers. Under other demand conditions a wait-and-see attitude will be chosen. More specifically, hiring and firing costs generate a corridor of inaction (status quo policy) within which firms do not change their workforce. This region is identified by the lower, Z_H, and higher, Z_F, control barriers. The definitions of the hiring and firing barriers, Z_H and Z_F, are given by the smooth-pasting and value-matching conditions below. According to the value-matching conditions the firm would find it optimal to exercise its option to hire or fire the marginal worker once Z hits one of the two barriers

$$(19)\qquad \frac{\frac{1-\alpha}{\psi} Z_H \Lambda^{\frac{1}{\psi}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}-1}}{r+\frac{\lambda(1-\alpha)}{\psi}-\eta-\frac{\eta_\Lambda}{\psi}} - \frac{w(1+\tau)}{r+\lambda-\eta_w} + A_2\left(Z_H \Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_2} = H + A_1\left(Z_H \Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_1}$$

and

$$(20)\qquad -\left[\frac{\frac{1-\alpha}{\psi} Z_F \Lambda^{\frac{1}{\psi}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}-1}}{r+\frac{\lambda(1-\alpha)}{\psi}-\eta-\frac{\eta_\Lambda}{\psi}} - \frac{w(1+\tau)}{r+\lambda-\eta_w}\right] + A_1\left(Z_F \Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_1} = F + A_2\left(Z_F \Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_2}.$$

The left-hand side of (19) has the marginal benefit of hiring which includes the acquired firing option. The right-hand side has the marginal cost of hiring, which includes the sacrificed hiring option. Similarly for equation (20), the left-hand side has the marginal benefit and the right-hand side the marginal cost of firing. There are four unknown variables, Y_H, Y_F, A_1, and A_2, in equations (19) and (20).

The smooth-pasting conditions ensure that hiring (firing) is not optimal either before nor after the hiring (firing) threshold is reached. In technical terms, this means

$$(21)\qquad \frac{\frac{1-\alpha}{\psi} \Lambda^{\frac{1}{\psi}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}-1}}{r+\frac{\lambda(1-\alpha)}{\psi}-\eta-\frac{\eta_\Lambda}{\psi}} + \beta_2 A_2\left(\Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_2} Z_H^{\beta_2-1} = \beta_1 A_1\left(\Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_1} Z_H^{\beta_1-1}$$

and

$$(22) \qquad -\frac{\frac{1-\alpha}{\psi}\Lambda^{\frac{1}{\psi}}K^{\frac{\alpha}{\psi}}L^{\frac{1-\alpha}{\psi}-1}}{r+\frac{\lambda(1-\alpha)}{\psi}-\eta-\frac{\eta_\Lambda}{\psi}}+\beta_1 A_1\left(\Lambda^{\frac{1}{\psi}}L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_1}Z_F^{\beta_1-1}=\beta_2 A_2\left(\Lambda^{\frac{1}{\psi}}L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_2}Z_F^{\beta_2-1}.$$

To determine the optimal labour demand policy of the firm one needs to identify the no-action-zone. This involves calculating the optimal upper and lower control barriers as functions of the parameters of the model. There are no closed-form solutions to the model. However, the non-linear system of equations (19) - (22) with unknown parameters Z_H, Z_F, A_1, and A_2 can be solved numerically once the solutions for β_1 and β_2 are obtained from (18). This allows calibrations of the model and makes the model amenable to graphical analysis.

4. The New Chinese Labour Law and Employment: Illustrative Model Simulations

The preceding section has laid out the model economy. Having illustrated that the stochastic framework has important ramifications for the dynamic behaviour of employment, we proceed in this section to use the theoretical framework above to carry out a number of calibrations shedding light on the workings of the models and the economic forces at work. For this reason, the model is calibrated in order to match characteristics of the Chinese economy. The use of consensus estimates ensures that the calibration is based on the best up-to-date knowledge in the literature. In this way, applied economic modelling is likely to increase the credibility of the policy analysis. Whereas it is not possible to quantify the values of some parameters, economic common sense is used to make sure that the implication of such choices is not far away from reality.[18]

We interpret time (*t*) as years and annual rates are used where applicable. Our base parameters are σ = 0.2, r = 0.12, δ = 0.05, η = 0.08, η_Λ = 0.029, η_w = 0.08, α = 0.59, and ψ = 1.2. The drift terms η = η_w = 0.08 reflects the notable growth of the Chinese economy over time. The profit share (wage share) is assumed to be 0.59 (0.41).[19] The growth rate of total factor productivity is assumed to be 2.9 percent per year.[20] This compares very favourably compared to other economies. Chinese exports mainly face competitive markets with rather elastic demand, and as a result most Chinese

[18] Note that the goal of this paper is not to derive precise quantitative estimates of the impact of various labour market regulations, but rather to illustrate the qualitative predictions of our stylised model and to identify key features of the framework in determining the policy´s quantitative impact. Jensen (2002) refers to "compromise values" when choosing benchmark parameters that appear plausible for empirical studies.
[19] See He et al. (2006), p. 10.
[20] See He et al. (2006), pp. 10-11.

producers are price takers to some extent.[21] Furthermore, structural reforms on Chinese product markets have covered a wide range of areas such as the privatisation policy, regulatory reform, and fostering competition from abroad. The immediate impact of such reforms facilitating entry of new competitors typically concerns allocative efficiency. We therefore assume ψ = 1.2. The required rate of return is based on the firm´s cost of capital, plus a risk premium to reflect the project´s specific risk characteristics. The proper estimation of *r* therefore hinges on determining how market participants value risk-return opportunities given existing alternatives. In our baseline scenario we assume r = 0.12.[22] The initial values of capital, employment, productivity, and wages are all normalised as 1, i.e. $K = 1$, $L = L_0 = 1$, $\Lambda = \Lambda_0 = 1$, and $w = w_0 = 1$.

A number of different proxies for employment rigidity have been used in the literature, none of which has emerged as a clear favourite. Clearly, the design of labour market institutions is multifaceted and often of a highly qualitative nature, which is not easily captured in quantitative measures. Our employment protection parameters are drawn from the World Bank *Doing Business* Database which provides detailed cross-country information on the *de jure* labour legislation in 178 countries around the world, using a standard methodology for all of them.[23] The rigidity of employment index is a synthetic indicator of the stringency of employment protection, summarising different interrelated aspects of the legislation. Finally, the last three columns convey quantitative measures of the speediness of employment adjustment.

Table 1: The Ease of Employing Workers – China Compared to Selected Economies

Country	Firing Costs (in Terms of Weekly Wages)	Non-Wage Labour Cost (% of wages)	Difficulty of Firing Index	Difficulty of Hiring Index	Rigidity of Employment Index
China	91	44	40	11	24
Thailand	54	6	0	33	18
Vietnam	87	17	40	0	27
India	56	17	70	0	30
Philippines	91	7	30	5	35
Hong Kong	62	5	0	0	0
United States	0	8	0	0	0
United Kingdom	22	11	10	11	7
Germany	69	19	40	33	44

[21] For example, in the year 2005 the top three markets where Chinese producers occupy the largest world market shares are textiles (35%), footwear (60%), and toys (40%). Most of these goods are characterised as low value-added and easy-to-substitute.

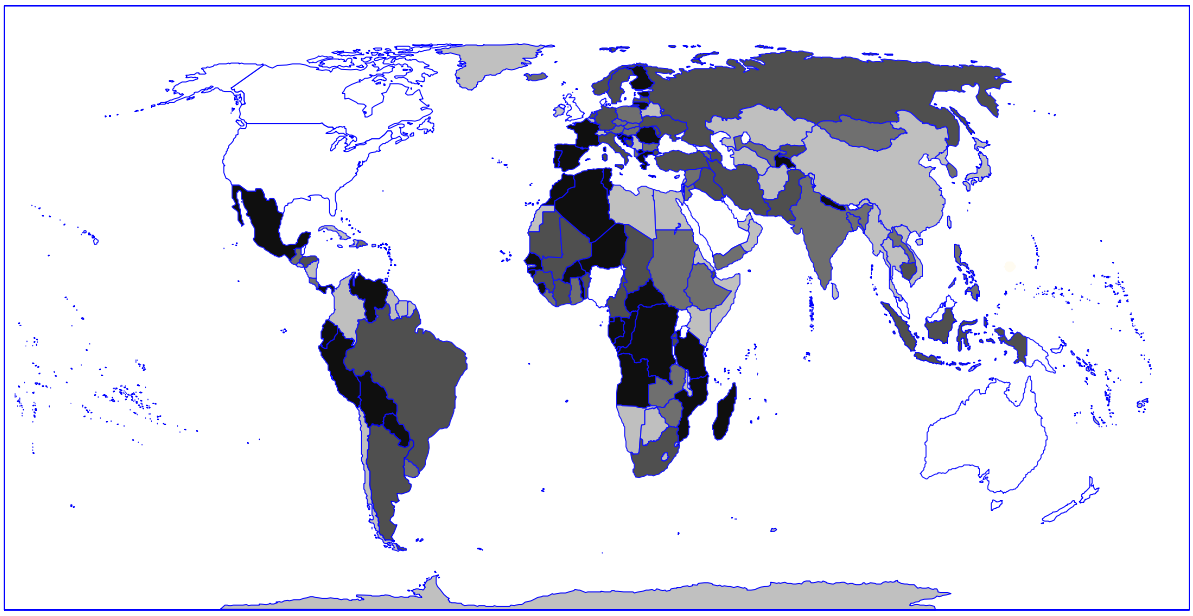
[22] Bentolila and Bertola (1990) have assumed r = 0.10 for advanced economies.

[23] There are limitations to the international and historical comparability of the measures. For example, in interpreting the numbers it must be borne in mind that summary indicators do not capture certain nuances which may nevertheless considerably affect the impact of employment flexibility. For instance it is difficult to take into account how procedures are actually applied, particularly where courts are involved. Furthermore, while the interests of workers are increasingly enshrined in law, their rights on the factory floor often remain precarious and are routinely ignored or violated by management.

Notes: All data have been derived from the Worldbank *Doing Business* Database (see http://www.doingbusiness.org/Documents/CountryProfiles/CHN.pdf). In the *Doing Business* Database, it is assumed that the company is a limited liability manufacturing corporation that operates country's most populous city. It is 100% domestically-owned, and has 250 employees. The representative worker is assumed to have 20 years of tenure in the same firm. The cost of firing indicator measures the cost of advance notice requirements, severance payments and penalties due when firing a worker, expressed in terms of weekly wages. Flexibility of firing covers workers' legal protections against dismissal, including the grounds for dismissal, procedures for dismissal (individual and collective), notice period, and severance payment. Flexibility of hiring covers the availability of part-time and fixed-term contracts. Finally, the rigidity of employment index is the average of the various sub-indices. The indices range from 0 to 100, with higher values indicating more rigid regulations.

How does this law compare to similar laws that other emerging economies have on the books? Is this new labour contract law unprecedented or is China simply catching up with its peers? It is in relation to firing costs where mainland China looks rather bad by world standards: these amount to 91 weeks of wages, compared with 62 weeks in Hong Kong. Overall, Table 1 indicates that China is a relatively difficult labour market in terms of firing costs and non-wage labour costs. In terms of hiring workers, China performs similar to its regional peers. Overall, the World Bank's *Doing Business* Database still ranks China above its regional peers India, the Philippines and Vietnam. Conversely, mainland China ranks far below Hong Kong. Furthermore, Figure 1 indicates that China still has a moderate overall employment regulation intensity on the global scale.[24]

Figure 1: The Overall Rigidity of Employment Index on the World Scale



[24] China is ranked 86 overall for Employing Workers. Regardless of how it compares to labour laws in other countries, it is likely the first time a labour market of this size and significance has so swiftly shifted the balance of power away from the employers and into the hands of the workers and unions.

Notes: The index ranges from 0 to 100, with higher values indicating more rigid regulations. White shade: 0 < index ≤ 17; light-grey shade: 17 < index ≤ 28; medium-grey shade: 28 < index ≤ 38; dark-grey shade: 38 < index ≤ 48; black shade: index > 48.

The numbers in the first column of Table 1 indicate that firing costs in mainland China are unusually high by international standards. However, the number is by no means as highly objective as it may appear at first glance. The reason is that it is based on very long tenure (20 years of service). Since we don´t want to resort to a less-than-realistic scenario, we assume a worker with 5-7 years of continuous employment in the same firm. Based on a contextual inquiry and a back-of-the-envelope calculation, we assume firing costs of $F = 1.0w$ for a worker.[25] The hiring costs are assumed to be $H = 0.1w$.[26] Finally, the non-wage labour costs are assumed to be $\tau = 0.44$.[27] These assumptions lead to the following benchmark for adjustment-related costs ensuring a realistic scenario: $c_h = 0.01 \times w$, $c_f = 0.1 \times w$, $\gamma_h = 0.1$, $\gamma_f = 1.0$, $p_h = 0.055 \times w$, $p_f = 0.553 \times w$ such that $H = 0.055 + \sqrt{2 \times 0.01 \times 0.1} = 0.1w$ and $F = 0.553 + \sqrt{2 \times 0.1 \times 1.0} = 1.0w$.

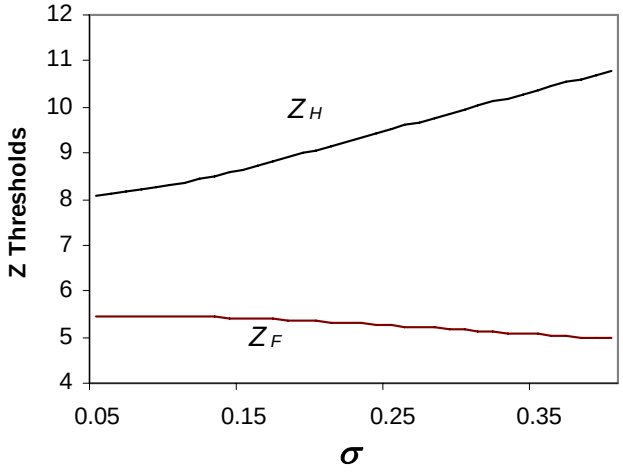
We first vary the degree of uncertainty σ to to develop a "feel" for the model and to "draw a map" of the employment sensitivity to various structural characteristics of the environment in which firms operate.

[25] Bentolila and Bertola´s (1990) estimates of firing costs in Germany are in the range $0.56 \leq F \leq 0.75$ of the annual wage. The ratio *F*-Germany/*F*-China = 0.75/1.0 can also be reconciled with the ratio of firing costs across countries in Table 1 (*F*-Germany/*F*-China = 69/91 ≈ 0.75).

[26] The hiring costs are broadly consistent with the recruiting and training cost in Bentolila and Bertola´s (1990) and Mortenson and Pissarides´ (1999) calibration. They suggest that this number is consistent with survey results reported in Hamermesh (1993). While the choices of *c*, γ_h, and γ_f might seem arbitrary, it is noted that in additon to achieve reasonable effective hiring and firing costs (*H* and *F*), the corresponding *I* and related adjustment cost are plausible: $I = \sqrt{2c_h/\gamma_f} = \sqrt{2c_h/\gamma_f} = 0.44$. For the normalized *L* = 1, *I* = 0.44. implies that the firm could hire/fire 44 percent of workers in a year at the maximum.

[27] One issue for employment performance when analysing non-wage labour costs is the extent to which the total tax wedge on labour bears on the employer in terms of increased labour costs. This is because increases in non-wage labour costs can be shifted between employers (in the form of increased labour costs) and workers (in the form of reduced take home pay) by adjusting the wage level.

Figure 2: The Impact of Uncertainty Upon the Employment Thresholds



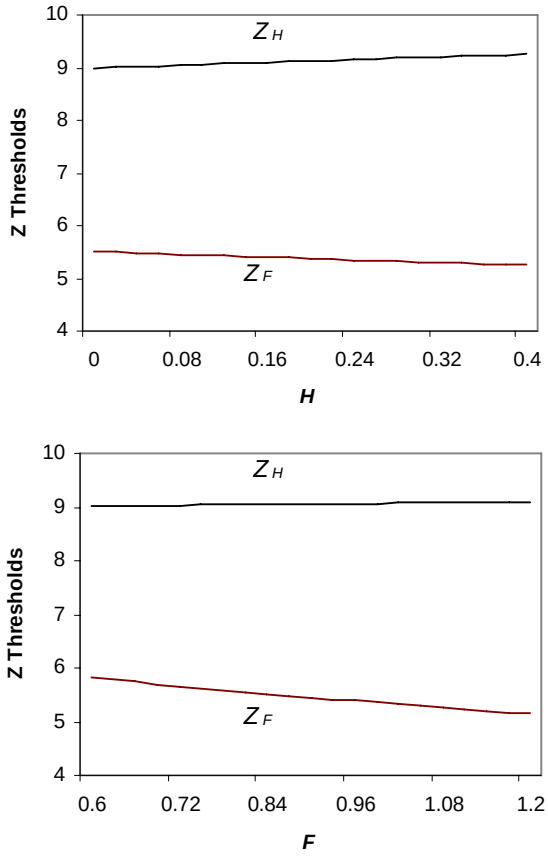
The results in Figure 2 indicate that the intertemporally optimising employer merely perceives there to be the possibility of a change in demand and profitability at some point in the future having an impact upon optimal employment. When firms perceive prevailing demand conditions to be transitory, in the sense that there are more frequent changes, then firms are more reluctant to hire or fire workers, i.e. a larger σ will lead to a considerable widening in the no-action-zone. Conversely, smaller values of σ results in a shrinking of the zone. In other words, in volatile environments, the best tactic is to keep options open and await new information rather than take an employment decision today. The intuition is that the firm can counteract the impact from additional uncertainty by a wait-and-see attitude for the time being.

Figure 3 investigates numerically the impact of higher/lower hiring and firing costs in equation (9) and (10). The major result of the calibrations is that higher hiring and firing costs lead to an increase of the no action area, i.e. increasing hiring and/or firing costs increase the (upper) hiring threshold (Z_H) and decrease the (lower) firing threshold (Z_F).[28] On the one hand, laws designed to protect workers against firing dampen unemployment because existing workers are fired less easily.[29] On the other hand, firing costs make it more difficult for firms to fire workers, so firms hesitate to hire them in the first place, strengthening the hand of workers who already have a job. Fewer workers become unemployed, but those unlucky few are also less likely to find a job. The effects of tighter firing costs on employment are therefore theoretically ambiguous, i.e. higher adjustment costs do not necessarily imply lower average employment.

[28] There could also be efficiency considerations to the extent that hiring and firing regulations and less speedier employment adjustment lead to long-lasting work relationships that encourage firms´ investment in the human capital of their workers, thus promoting productivity improvements.

[29] The lowish estimates of the economic impacts of the labour contract law miss out one thing. More stringent employment protection may reduce firms´ ability to cope with a rapidly changing global economy and take advantage of the opportunities offered by new technologies and access to new markets. Hopenhayn and Rogerson (1993) have presented a general equilibrium model with entry and exit of firms and show that a tax on job destruction can reduce employment significantly.

Figure 3: The Employment Thresholds for Alternative Hiring and Firing Costs



One caveat of the previous analysis is that the graphs don´t specify the level of employment over time. Since the focus of the paper is employment, we next present a translation from thresholds to employment and assess the impact of various parameters upon labour demand. In order to get a clear "feel" for the dynamics of the model, we first have to specify a solution method that will lead us to generate discrete realizations of the level of employment, given the chosen levels of parameters. Several options are available at this point, but the structure of the model readily suggests using a sequential iterations method. It works as follows. Equation (7) is proxied by the following discrete stochastic differential equation - the Euler scheme,

$$(23) \qquad Z_{t+1} = Z_t + \eta Z_t \Delta t + \sigma Z_t \varepsilon_t \sqrt{\Delta t}\,, \qquad \varepsilon_t \sim N(0;1),$$

where the normal random variables, ε_t, are generated via the central limit theorem and the Box-Muller (1958) method for standardised normal distribution and Δt denotes small changes in time. Over time, the firm does nothing as long as the values for Z_t generated by equation (23) fluctuate within the thresholds of hiring and firing – the inaction area. Note that as time passes, some workers quit and thus the inaction area shift downward due to the lower value of L even when the firm

doesn´t hire or fire. For every step in time Δt, the firm hires $\sqrt{2c_h/\gamma_h}\Delta t$ or fires $\sqrt{2c_f/\gamma_f}\Delta t$ if Z_t hits either Z_H or Z_F. Thus, the gross changes in employment are govern by the following two discrete-time versions of equation (5):

(24) $L_{t+1} = L_t + \left(+\sqrt{2c_h/\gamma_h} - \delta L_t\right)\Delta t$ for hiring

and

(25) $L_{t+1} = L_t + \left(-\sqrt{2c_f/\gamma_f} - \delta L_t\right)\Delta t$ for firing.

As the time passes, the term Z_t fluctuates according to the corresponding stochastic processes and L_t declines according to the exogenous quite rate as long as Z_t is staying within the no-action area. If Z_t hits the thresholds (Z_H or Z_F), the firm will hire (or fire) employees to raise (or lower) L so that Z_t is again within the no-action area soon, depending on the values of γ.

All the above discussion has been concerned with the employment decision of a single firm. From a macroeconomic point of view, however, the question of primary interest is the impact of uncertainty and (partial) irreversibility on aggregate employment. Yet it is obvious that one cannot just translate mechanically the above microeconomic partial equilibrium results to aggregate employment. To assess the role of irreversibility in aggregate factor demand it is essential to take explicitly into consideration the heterogeneity of individual firms´ hiring and firing decisions. Suppose that we re-interpret the model at the macroeconomic level, i.e. L now represents aggregate employment. Unlike microeconomic data, aggregate employment series look smoother since microeconomic adjustments are far from being perfectly synchronized. The question arises as to whether aggregation eliminates all traces of infrequent lumpy microeconomic adjustment. We again focus on employment (L), and we model aggregate employment in terms of average employment of a number of individual firms indexed by $i \in [1,3000]$.[30] Using this analytical tool, we solve the model with 3000 different seeds

[30] We ignore behavioural assumptions regarding market rivalry, which in turn would necessitate some kind of game-theoretic analysis to take account of the strategic interactions among the firms, results of which are in turn heavily dependent on assumptions regarding the information sets available and the type of game being played. The ramifications of competitive interaction on the decision making of firms have been discussed by Smit and Ankum (1993) and Leahy (1993). Leahy (1993) has shown that the assumption of myopic firms who ignore the impact of other firms´ actions results in the same critical boundaries that trigger factor demand as a model in which firms correctly anticipate the strategies of other firms. Grenadier (2002) has recently extended Leahy´s (1993) "Principle of Optimality of Myopic Behavior" to the apparently more complex case of dynamic oligopoly under uncertainty. Both papers therefore permit to bypass strategic general equilibrium considerations when analysing factor demand under uncertainty.

for the random number generator. The resulting time series for aggregate employment are displayed in Figure 4 and 5 below.[31]

Figure 4: Aggregate Employment Dynamics for $\eta = 0.08$ and $Z_0 = 8.0$

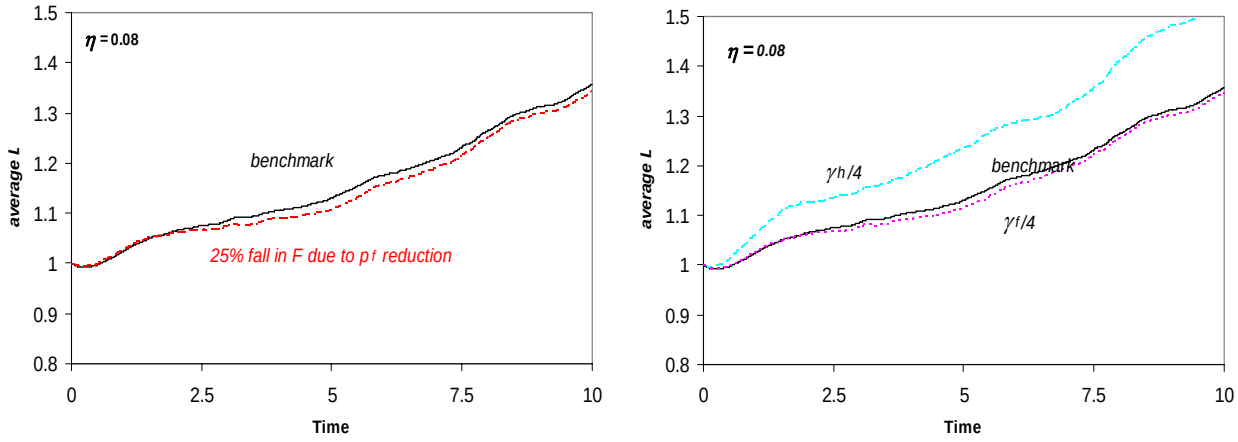


Figure 5: Aggregate Employment Dynamics for $\eta = 0.06$ and $Z_0 = 8.0$

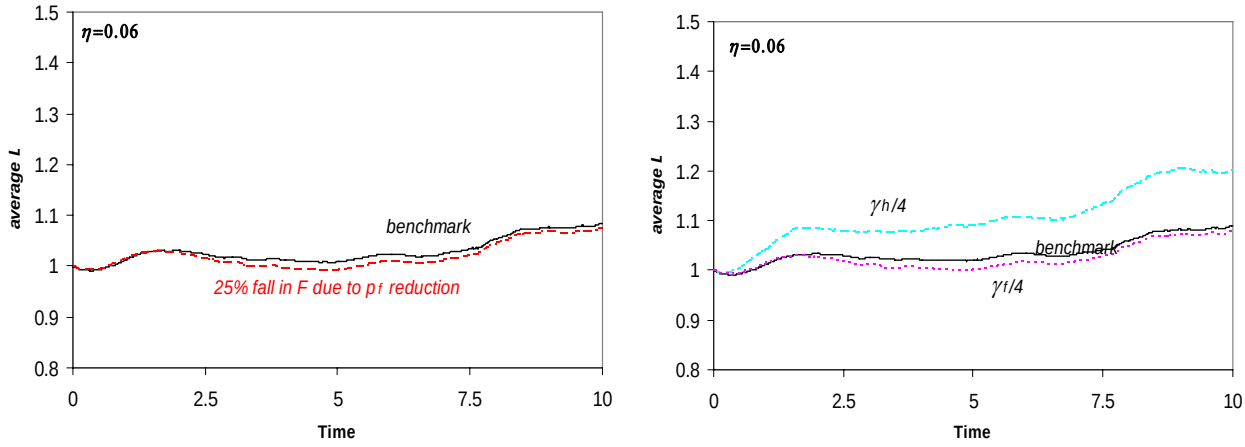


Figure 4 and 5 simulate the aggregate employment dynamics for deterministic drift terms $\eta = 0.08$ vs. $\eta = 0.06$ in (7) vs. (23) and alternative hiring and firing related costs. The deterministic drift term $\eta = 0.08$ in Figure 4 reflects the fast-growing Chinese economy and leads to an increase of employment of 20 – 30 percent over a 10 year horizon. The simulated employment dynamics provides a numerical measure how employment varies with growth in economic output, i.e. the series serves as a useful way to examine how growth in output and growth in employment evolve together over time.[32]

[31] Experimentation with larger numbers of runs shows no significant change to the results.

[32] In Figure 4 and 5, aggregation eliminates all traces of infrequent lumpy microeconomic adjustment. This smooth adjustment feature is consistent with the evidence in Caballero et al. (1995). The authors have proposed a framework allowing to link the probability distributions of the state of individual factor demand to

This implied employment elasticity is broadly consistent with the country-level estimates of the *International Labour Organization* for the period 2001 – 2005 and therefore the benchmark parameterisation of the model gets the employment-side of the macroeconomic picture right.[33]

The dashed line in the left panel of Figure 4 indicates that a 25 percent fall in overall firing costs F due to fall in p_f. On the contrary, the right panel of Figure 4 summarises the inferences that can be drawn from reducing γ_F vs. γ_H and therefore the speediness of employment adjustment. The essence is that in a fast-growing economy less stringent firing costs have a negligible impact upon employment.[34] On the contrary, a lower γ_H parameter accelerates the job creation. Such a reduction of γ_H can be interpreted as a matching process that becomes more efficient generating less labour market frictions.[35] Interestingly, the positive impact of such a reform turns out to be weak in the short run, suggesting that the full realisation of the employment gains are revealed not until some time had elapsed.

All else being equal, Figure comprises the results for η = 0.06. As expected, the lower average growth rate of demand in conjunction with the same cost pressure leads to lower employment. Noteworthy, the qualitative results concerning F, γ_F and γ_H are reobtained. Thus, the message of Figure 4 and 5 is that we can take some comfort that the new Labour Contract Law will not cause lower employment in mainland China.

A proper discussion of the effects that changing labour market regulation brings to the rest of the economy demands that induced wage increases are discussed. A relevant feature of the modelling framework is that firing costs create a hold-up problem [see, e.g. Caballero and Hammour (1998)] enabling insiders (incumbent workers) to bid up wages once they are employed. In other words, firing costs make it difficult for firms to fire workers, so firms hesitate to hire them in the first place, strengthening the hand of workers who already have a job.

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cross-sectional distributions at aggregate levels. The paper suggests that idiosyncratic shocks tend to smooth out microeconomic rigidities by spreading agents in state space.

[33] The higher the elasticity, the more employment-intensive is economic growth. Chapter 19 of http://www.ilo.org/public/english/employment/strat/kilm/ indicates that mainland China had an employment elasticity of about 20 percent over the period 2001 – 2005. η = 0.08 implies a growth rate of $(1+0.08)^{10} \approx 116$ percent over a 10 year horizon. A growth rate of employment of 25-30 percent over the same horizon therefore implies an employment elasticity of 20-25 percent, i.e. a 1 percent increase in GDP is associated with employment growth of 0.2 – 0.25 percent.

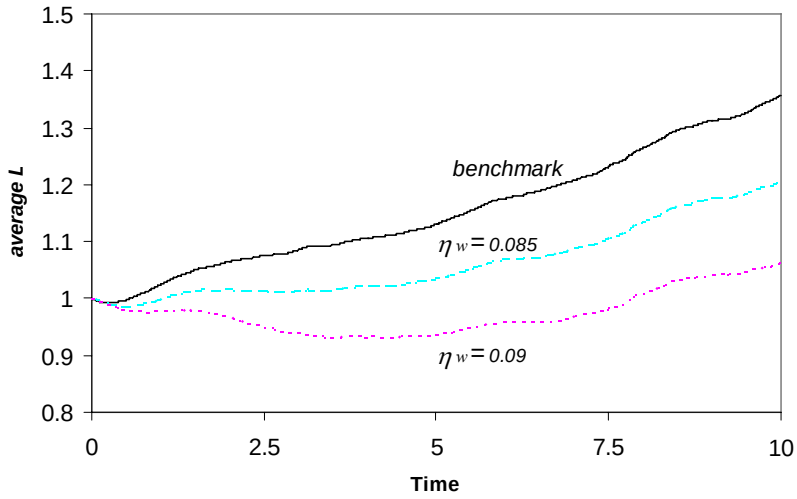
[34] This qualitative conclusion is similar to other studies conducted under this vein. See, for example, Bentolila and Bertola (1990).

[35] This confirms that more stringent hiring costs may be particularly problematic. There appears to be relatively straightforward empirical evidence that stringent employment protection legislation has a strong effect on market access of small- and medium-sized firms. It may be interesting to note, however, that the negative impact of heavy-handed regulation is found to stem not so much from barriers to entry as barriers to expansion, notably job protection laws that discourage new hirings [see OECD (2002)]. Since the difficulty of hiring in mainland China is still fairly low by international standards, the momentum for employment growth in China my not be reduced by the new Labour Contract Law.

Reports of labour shortages first cropped up in 2005, but observers initially thought the phenomenon was temporary. Now a surge in both turnover and wage costs is convincing multinationals and their suppliers that the China game has changed permanently with the gap between wages in China and those elsewhere gradually closing.[36] Many firms are trying to escape rising wage costs by relocating on the mainland. But there are plenty of signs that labour costs are also rising in the Chinese hinterland. And no matter where they relocate on the mainland, manufacturers face the pressure from the appreciating renminbi and the elimination of tax rebates on many items used to make exported goods.

Real manufacturing wages in China have more than doubled over the period 1995 – 2002.[37] In the year 2007, increases in unit labour costs in manufacturing have also become more significant.[38] As part of this power shift from employers to workers, we therefore adapt our simulations by assuming alternative wage growth trajectories. More precisely we assume that the new Labour Contract Law may encourage workers to demand higher wages. Rather than presenting static thresholds, we again focus upon the dynamic employment effects. In Figure 6, the implications of alternative wage drift terms η_w are illustrated graphically.

Figure 6: The Employment Effect of Alternative Wage Drift Terms η_w with $Z_0 = 8.0$



The three alternative η_w drift terms typify different future wage pressures in the Chinese economy. Not surprisingly, higher wage growth rates (η_w = 0.085 and η_w = 0.09) compared to the benchmark (η_w = 0.08) lead to much lower employment. In other words, the two dashed lines indicate that the new Chinese Labour Contract Law might raise costs in an already tightened labour market leading to

[36] Wages are rising for several reasons. Despite the increase in highly-skilled workers, a shortage of highly-skilled labourers continues meaning that they can demand higher wages from companies lacking such skills. This has a knock-on effect on lower-level wages, as these workers feel encouraged to demand higher wages.

[37] See Figure 15c of http://www.ilo.org/public/english/employment/strat/kilm/download/kilm15.pdf.

[38] See Figure 9 in http://siteresources.worldbank.org/CHINAEXTN/Resources/cqu_june08_en.pdf for empirical evidence.

wage growth remaining in “fast lane”. Taking the numerical simulations into consideration, we conclude that induced increasing unit labour costs represent the real issue and “achilles heel” for future employment growth in China.

5. Concluding Remarks

On January 1, 2008, the Chinese Labour Contract Law went into effect, ushering in sweeping changes to Chinese labour policy. A proper discussion of the effects that changing labour market regulation brings to the rest of the economy demands that policy changes are placed within the context of economic theory. This paper is an attempt at providing a theoretical framework that clarifies thinking on the inter-linkages between labour market regulation, option value and the choice and timing of employment. All in all, the paper demonstrates that the Labour Contract Law in a literal sense is no “wreaking havoc” and will not reduce employment in law-abiding firms. This result is robust to different assumptions made in calibrating the model.

In contrast, higher future wage growth outpacing labour productivity growth will definitely slow employment down. The underlying motivation for the new Labour Contract Law may therefore be that China no longer wants to be the home of low-skilled, low-cost, low-margin manufacturing. Instead, Chinese companies should try to move up in the value chain. The government is backing the drive with a two-pronged approach: using incentives to encourage companies to innovate, but also moving to discourage low-end manufacturers from operating. By introducing tougher labour standards, the government has sent a powerful signal about its global ambitions, and helped encourage an exodus of factories from an area long considered the world´s shop floor. The Chinese government policies now favour high-tech economic zones, research and development centers and companies that promise higher salaries and more skills. It remains an open question whether this strategy creates sufficient employment opportunities for the large number of impoverished workers and translates into favourable outcomes, such as poverty alleviation.

Appendix *A*: Derivation of Equation (9) and (10)

The Bellman equation for the value V at time zero is given in equation (8) in the main text. The first-order conditions for gross employment changes (I) of equation (8) in the text are denoted by

(A1) $$\pm p_{h/f} + \gamma_{h/f} I = v,$$

where $v = V_L$. Substituting the above equations into equation (8) yields

(A2) $$\begin{aligned} rV = {} & Z\Lambda^{\frac{1}{\Lambda}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}} - w(1+\tau)L - c_h + \frac{1}{2}\frac{(v-p_h)^2}{\gamma_h} \\ & - \lambda L v + \eta_w w V_w + \eta_\Lambda \Lambda V_\Lambda + \eta Z V_Z + \frac{1}{2}\sigma^2 Z^2 V_{ZZ} \end{aligned}$$

for hiring and

(A3) $$\begin{aligned} rV = {} & Z\Lambda^{\frac{1}{\Lambda}} K^{\frac{\alpha}{\psi}} L^{\frac{1-\alpha}{\psi}} - w(1+\tau)L - c_f + \frac{1}{2}\frac{(v+p_f)^2}{\gamma_f} \\ & - \lambda v N + + \eta_w w V_w + \eta_\Lambda \Lambda V_\Lambda + \eta Z V_Z + \frac{1}{2}\sigma^2 Z^2 V_{ZZ} \end{aligned}$$

for firing. Due to fixed costs of hiring and firing, the firm would only hire/fire workers whenever the total benefits of hiring/firing are greater than the corresponding total adjustments costs. Therefore, for hiring decisions $(I \geq 0)$, the benefits of hiring I employees, Iv, must be greater than its total adjustment costs, $c_h + p_h I + \frac{1}{2}\gamma_h I^2$.

(A4) $$Iv - \left(c_h + p_h I + \frac{1}{2}\gamma_h I^2 \right) \geq 0.$$

In case of firing $(I \leq 0)$, v is negative. Thus, the total benefits of firing $|I|$ employees is captured by Iv; while the total adjustment costs of firing are $c_f - p_f I + \gamma_f M^2 / 2$. Thus the firm will fire workers as long as the following equation is satisfied:

(A5) $$Iv - \left(c_f - p_f I + \frac{1}{2}\gamma_f I^2 \right) \geq 0.$$

Equations (A4) and (A5) can be simplified by using (A1):

(A6) $$I \geq \sqrt{\frac{2c_h}{\gamma_h}} > 0 \qquad \text{for hiring}$$

and

(A7) $I \le -\sqrt{\frac{2c_f}{\gamma_f}} < 0$ for firing.

The boundaries of the inaction area are then represented by following equations:

(A8) $v = p_h + \sqrt{2c_h\gamma_h}$ for the hiring threshold

and

(A9) $v = -p_f - \sqrt{2c_f\gamma_f}$ for the firing threshold.

Substituting (A8) and (A9) back into (A2) and (A3) respectively gives (13) in the text.

Appendix *B*: Derivation of Equations (16) and (17)

The homogeneous part of equation (13) is denoted by

(B1) $(r+\lambda)v = -\lambda L v_L + \eta_w w v_w + \eta_\Lambda \Lambda v_\Lambda + \eta Z v_Z + \frac{1}{2}\sigma^2 Z^2 v_{ZZ}$

We assume that the homogeneous solutions have the functional form

(B2) $v = A\left(Z\Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^\beta$,

where A is an unknown variable to be determined by the boundary conditions of hiring and firing. Note that K is assumed to be constant and hence does not affect the value of homogenous solutions. Therefore, we have

(B3) $-\lambda L v_L = -\lambda\left(\frac{1-\alpha}{\psi}-1\right)\beta A\left(Z\Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^\beta$,

(B4) $\eta_w w v_w = 0$,

(B5) $\eta Z v_Z = \eta\beta A\left(Z\Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^\beta$,

(B6) $\eta_\Lambda \Lambda Z v_\Lambda = \frac{\eta_\Lambda}{\psi}\beta A\left(Z\Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^\beta$,

(B7) $\frac{1}{2}\sigma^2 Z^2 v_{ZZ} = \frac{1}{2}\sigma^2\beta(\beta-1)A\left(Z\Lambda^{\frac{1}{\psi}} L^{\frac{1-\alpha}{\psi}-1}\right)^\beta$

Substituting the above equations back into equation (B1) yields

$$\text{(B8)} \qquad \left(\frac{1}{2}\sigma^2\beta(\beta-1)+\eta\beta+\frac{\eta_\Lambda}{\psi}\beta-\frac{1-\alpha}{\psi}\lambda\beta-r\right)A\left(Z\Lambda^{\frac{1}{\psi}}L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta}=0.$$

Equation (B7) must hold for any value of A. Thus, we have

$$\text{(B9)} \qquad \frac{1}{2}\sigma^2\beta(\beta-1)+\eta\beta+\frac{\eta_\Lambda}{\psi}\beta-\frac{1-\alpha}{\psi}\lambda\beta-r=0.$$

Note that there are two characteristic roots for equation (B9). Therefore, the general solutions are denoted by

$$\text{(B10)} \qquad v=A_1\left(Z\Lambda^{\frac{1}{\psi}}L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_1}+A_2\left(Z\Lambda^{\frac{1}{\psi}}L^{\frac{1-\alpha}{\psi}-1}\right)^{\beta_2},$$

where $\beta_1>0$ and $\beta_2<0$.

References:

Abel, A.B. and J.C. Eberly (1994), 'A Unified Model of Investment Under Uncertainty', *American Economic Review* 84, 1369-1384.

Acemoglu, D., Johnson, S. and James A. Robinson (2005) "Institutions as a Fundamental Cause of Long-Run Growth", in: Aghion, P. and S. Durlauf (eds.) *Handbook of Economic Growth*, Vol. 1A, 385-472, Amsterdam (Elsevier).

Addison, J.T. and P. Teixeira (2003) "The Economics of Employment Protection", *Journal of Labor Research* 24, 85-129.

Bentolila, S. and G. Bertola (1990), 'Firing Costs and Labor Demand: How Bad is Eurosclerosis?', *Review of Economic Studies* 57, 381-402.

Bertola, G. (2004) "A Pure Theory of Job Security and Labor Income Risk", *Review of Economic Studies* 71, 43-61.

Box, G. and M. Muller (1958), "A Note on the Generation of Random Normal Variables", *Annals of Mathematical Statistics*, 29, 610–611.

Caballero, R., Engel, E. and Haltiwanger, J. (1995) "Plant-Level Adjustment and Aggregate Investment Dynamics", *Brookings Papers on Economic Activity*, 2:1995, 1-54.

Caballero, R.J. and Hammour, M.L. (1998) "The Macroeconomics of Specificity", *Journal of Political Economy* 106, 724–767.

Chen, Y.-F. and Funke, M. (2004) „Working Time and Employment Under Uncertainty", *Studies in Nonlinear Dynamics and Econometrics* 8, Issue 3, Article 5, (www.bepress.com/snde/vol8/iss3/art5).

Chen, Y.-F. and M. Funke (2008) "Product Market Competition, Investment and Employment-Abundant versus Job-Poor Growth: A Real Options Perspective", *European Journal of Political Economy* 24, 218-238.

Cooney, S., Biddulph, S., Kungang, L. and Y. Zhu (2007) "China´s New Labour Contract Law: Responding to the Growing Complexitiy of Labour Relations in the PRC", *UNSW Law Journal* 30, 788-803.

Dixit, A. (1997) "Investment and Employment Dynamics in the Short Run and the Long Run", *Oxford Economic Papers* 49, 1-20.

Dixit, A. and R. Pindyck (1994), *Investment Under Uncertainty*, Princeton University Press, Princeton.

Eberly, J.C. and van Mieghem, J.A. (1997) "Multi-Factor Dynamic Investment Under Uncertainty", *Journal of Economic Theory* 75, 345-387.

Grenadier, S.R. (2002) "Option Exercise Games: An Application to the Equilibrium Investment Strategies of Firms", *Review of Financial Studies* 15, 691-721.

Hamermesh, D.S. (1993) *Labor Demand*, Princeton (Princeton University Press).

He, D., Zhang, W. and J. Shek (2006) "How Efficient has been China´s Investment? Empirical Evidence from National and Provincial Data", *Hong Kong Monetary Authority, Research Memorandum* 19/2006, Hong Kong (see http://www.info.gov.hk/hkma/eng/research/RM19-2006.pdf).

Hopenhayn, H. and R. Rogerson (1993) "Job Turnover and Policy Evaluation: A General Equilibrium Analysis", *Journal of Political Economy* 101, 915-938.

Jensen, H. (2001) "Targeting Nominal Income Growth or Inflation?", *American Economic Review* 92, 928-956.

Leahy, J. (1993) "Investment in Competitive Equilibrium: The Optimality of Myopic Behaviour", *Quarterly Journal of Economics* 108, 1105-1133.

Mortenson, D.T., Pissarides, C.A. (1999) "New Developments in Models of Search in the Labor Market", in: Ashenfelter, O.C. and Card, D. (Eds.) *Handbook of Labor Economics Vol. 3B*, 2567–2627, Amsterdam (Elsevier Science).

Nickell, S. and R. Layard (1999) "Labor Market Institutions and Economic Performance", in: Ashenfelter, O.C. and D. Card (eds.) *Handbook of Labor Economics*, Vol. 3C, Amsterdam (Elsevier), 3029-3084.

OECD (2002) *Benefits and Wages, OECD Indicators*, Paris.

Saint-Paul, G. (2000) *The Political Economy of Labour Market Institutions*, Oxford (Oxford University Press).

Smit, H. and Ankum, L. (1993) "A Real Options and Game-Theoretic Approach to Corporate Investment Strategy under Competition", *Financial Management* 22, 241-250.