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Monopoly Rights and Economic Growth: An inverted U-shaped relation

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Abstract

Supported by most theories, employment protection often is found to reduce economic growth. Almost all existing empirical studies, however, are based on data from continental Europe and Japan, where labor protection is generous. Using data for the United States, where labor protection is minimal, we find, by contrast, positive effects but only in knowledge-intensive industries. To reconcile these facts, we propose a simple theoretical model based on a hold-up problem arising from firm-specific investment. This makes some job security efficient and the relationship between job security and growth an inverted U-shaped, i.e., basic labor protection increases growth, but generous protection reduces it. Importantly, we show that a firm faces a time inconsistency problem so that its promise of job security is not credible. Thus, legal restrictions become valuable if they are well designed. Since job security is even less for financially distressed firms, interactions also arise between financial and labor laws, as powerful banks can demand more layoffs. Using U.S. state-industry data, we confirm these effects of bank competition and employment protection, as well as their interactions.

JEL Classification Numbers: O43, O16, J08, J83, G28, G33, G34

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I. INTRODUCTION

Productivity is the key determinant of long-run economic growth (e.g., Klenow and Rodriguez-Clare (1998) and Prescott (1998)) and of financial and capital flows (e.g., Alfaro et. al., 2008). The low productivity of poor countries is often associated with weak institutions (Acemoglu, et. al, 2005), and weak institutions often takes the form of monopoly rights, i.e., workers' and capitalists' entitlements—Parente and Presecott (2000) describe how workers' monopoly rights are major barriers for developing countries to grow, while Rajan and Zingales (2003) emphasizes the similar role of capitalists' monopoly rights.

Country case evidence seems to support this interpretation. The fall of India's and rise of Japan's textile industry in early 20th century, as highlighted by Prescott (1998) and Parente and Prescott (2000) and in turn based on studies by economic historians, are particularly insightful. India was a world top exporter of textile, but around 1900 was overtaken by Japan. The proximate reason behind India's fall was its low productivity due to limited investments in new machines, largely due to frequent labor strikes against labor-saving machines. Moreover, many strikes were backed by the state. On the contrary, few strikes occurred in Japan. The deeper cause between the two countries' labor strikes against adopting new technology, however, was a difference in worker characteristics. Indian workers were adult, male prime earners, who demanded job security, while Japanese workers were young girl from provinces, working temporarily – at most several years – before marriage.

However, this example raises a question whether even basic labor standards is always bad for the economy as, in Japan, girls' working in textile industries in early 20th century was widely perceived as a tragedy, a prototypical example of sweat shops, depicted in a classical book, *Joko-Aishi* (*Tragic History of Female Factory Workers,* Hosoi, 1925). Moreover, recently, factories in developing countries such as China are often criticized for their unreasonable work practices. Still, most formal theories predict that any labor market rigidity is detrimental to growth (e.g., Hopenhayn and Rogerson, 1993; and Bertola, 1994). And with few exceptions, empirical results, consistent with most theories, have so far shown that any labor market rigidity has negative, or at best insignificant, growth effects.

There are a few theoretical models that predict growth enhancing effects of employment protection. The mechanism modelled is often the following. Firm-specific human capital is essential in the production process. To solicit such investment, firms need to assure workers of some degree of job security (Murphy, 1986; Saint-Paul, 1996; and Takizawa, 2003).[1] Empirical evidence supportive of this mechanism is limited, however. This is, we surmise, largely because most studies focus on Western Europe or Japan, where labor protection is quite generous, with firing almost prohibitive in practice.[2] This high level of employment protection does not allow one to test whether a basic level of labor protection benefits economic growth.

We then test these theories, something which has not yet been done, using US experience because the US labor market is known to have little rigidity.[3] And, the US basic employment

[1] From a different viewpoint, Blanchard and Tirole (2008) shows that, given the dead-weight losses associated with unemployment insurance due to distortionary taxes, some employment protection can be socially optimal.
[2] See also Besley and Burgess (2004) who find that state-level pro-worker amendments in the relevant law lead to lower state outputs in India.
[3] We have since become aware of a microeconomic study by Atkin, et. al. (2015), who document that a better technology adoption by one of the soccer ball factories in Pakistan was influenced by the anti-sweat-shop policy of *Nike*.

protection, which essentially only prohibits unreasonable firing, has been installed gradually between 1970s and 90s and state by state. This experience, a quasi-natural experiment, has been studied in the existing literature and shown to have insignificant or mixed effects on state-level economic growth or employment (Dertouzos and Karoly (1992 and 1993), Miles (2000), Autor, Donohue, and Schwab (2006), and Autor, Kerr, and Kugler (2007)). These analyses, however, do not differentiate by need for firm-specific human capital, even though models predict that the growth enhancing effects of employment protection should appear only in those industries using human capital intensively. Sorting industries by their intensity of knowledge use, based on firm average data, we find that at the state-industry level, basic employment protection helps knowledge-dependent industries grow, consistent with firm-specific human capital theories. At the same time, industries that do not require much knowledge are hurt, in line with neo-classical views.

We then confront the differences between existing theories and our empirical findings. That is, existing theories predict the need for job security for those firms that require firm-specific human capital investment by workers. But, these theories allow, implicitly or explicitly, firms themselves to give such a job guarantee to their workers. This makes legal restrictions redundant.

However, our empirical results show the importance of legal restrictions, and theoretically we need to introduce a missing link. We propose a time-consistency issue: Firms would like to guarantee some level of job security but, without legal restrictions, cannot do so since if a bad shock hits, layoffs will be ex post efficient. This happens because financiers will pressure distressed firms to save labor costs and other expenditures.

We develop therefore a formal theory that addresses the time-consistency issue and provides a theoretical foundation consistent with our empirical results that basic labor protection can be efficient. The key in our rich model is to allow not only for varying effects of employment protection, but also to consider the degree of monopoly power of external financiers, which creates time-consistency issues, especially when firms get financially distressed.

Our model is an application of the costly state verification model of Townsend (1979), originally written to explain financial debt contract, to labor markets. Essentially, the theoretical model shows that given information asymmetries and the costs associated with layoffs, the endogenous optimal contract is a fixed wage contract. If information on productivity shocks is perfectly shared with all parties, no layoffs happen because wages would be made contingent on output shocks. If instead the signal for the productivity shock is known only to the firm manager and it can only be verified with some costs for workers, the optimal labor contract retains all the employees at the fixed wage for productivity shocks higher than a threshold. Below the threshold, it will be optimal, given the fixed costs incurred per targeted workers, to lay off a small number of workers rather than cut wages for all workers.

Our model also incorporates financial frictions that make distressed firms lay off some workers—in perfect financial markets, firms would not end up in distress. The financial contract that admits some form of default is a debt contract based (as well) on costly state verification. In this setup, workers and banks are two stakeholders interacting with the firm manager, who represents shareholders and offers take-it-or-leave-it contracts to banks and workers. Layoffs will then be determined by the relative strength of worker and creditor rights: if creditors are powerful, they will demand more repayments by cutting labor costs more; if they are weak, de facto job security is greater.

Importantly, our theory predicts an inverted-U shaped relation between labor protection and productivity: basic protection enhances productivity due to greater firm-specific knowledge investment, but generous protection reduces productivity. Because the previous empirical findings, particularly for continental Europe and Japan, have already shown the negative growth effects of generous worker protection, our empirical analysis focuses on finding empirical evidence to support beneficial effects by basic labor protection.

The U.S. over 1970s to 90s experienced gradually and state-by-state increases in both employment protection and bank branch deregulations, with the latter lowering bank monopoly rights. Using these data, we investigate the effects of worker rights, not only the absolute level, but also relative to banks' rights by including interaction terms between employment protection and bank branch deregulation. The interaction terms turn out to be statistically significant in state-industry growth regressions, showing that higher employment protection in combination with lower bank monopoly rights increase growth in knowledge-intensive industries.

Overall, both theory and empirical analyses find that relative job security resulting from a balance of labor and creditor monopoly rights can affect economic growth significantly. Our findings reconcile two seemingly conflicting views: rising basic labor protection boosts growth but generous labor protection hurts growth. The rest of the paper is organized as follows. In Section II, we revisit the empirical facts between basic labor standards and growth. In Section III, we develop our theoretical model focusing on contractual problems within a period. Section IV extends the model to a dynamic general equilibrium. Section V investigates empirically the interaction effects between labor and bank monopoly rights. The last section concludes.

II. Empirical Facts on US Experience, Revisited

A. Evolution of Basic Employment Protection in the US

The United States gradually established basic restrictions on unreasonable firing of workers from 1970s to 90s, state by state. Autor, Donohue, and Schwab (2006) document how, using initial precedent-setting case law, states adopted de facto wrongful discharge protection for employees.[4] They classify these forms of employment protection into three categories: public policy, good faith, and implied contract. Under the public policy exemption, employers cannot fire employees just because they follow public policy, such as performing jury duty, filing worker's compensation, reporting employer's wrongdoing, and so forth. Under the good faith exemption, employers cannot fire workers for "bad cause," primarily applied to "bad timing" cases, such as firing just before a salary due or pension threshold date (e.g., firing a worker after four and one-half years just before completing a five-year vesting period for pension). The implied contract exemption is somewhat vague, but has generally be interpreted as follows: without clearly stating in the employment contract that a company can fire a worker at will, workers should be kept employed according to their length of service, history of promotion, general company policy, industry practice, and so forth. Still, this

[4] Since these are precedent or case-based actions, they may not necessarily take effect in a uniform manner across the whole state immediately. While the dating consequently cannot be done unambiguously, many papers have used the same dates we use. Obviously, imprecision in dating biases our analyses towards finding no results. Note that there are some reversals where earlier recognized doctrines were overturned by the courts, which we account for.

exemption does not make it prohibitive for US firms to fire workers, unlike in some European countries and Japan, where more rigid labor laws make firing almost impossible for firms.

Considering how they protect workers, these rights can be considered "basic" labor standards. While some labor rights can be secured contractually, our theory suggests that it is beneficial to standardize and secure basic rights, by law or court, in the presence of time inconsistency problems (and possible externalities) in designing and enforcing privately-negotiated contracts.[5] In particular, basic employment protection becomes more valuable when there are firm- or sector-specific human capital investment needs. Protecting workers from firing without good reason can encourage workers to acquire more specialized skills and thereby enhance firm performance in those industries that demand greater firm-specific investments.

For our empirical analyses, we create four employment protection indexes, depending on which, if any, of the three protections is adopted or recognized by the specified state court, or if any of the three is introduced, with each index having a binary value of 1 or 0: *WorkRight = public policy*; *good faith*; *implied contract*; or *earliest*. For the period of 1972 to 1993, Figure 1 depicts the number of states that have adopted the three forms of employment protection. Summary statistics, including those for all other variables used in this paper, are shown in Table 1a. Table 1b shows correlation among the three employment protection indexes, with the highest between contract and public policy, 0.54, meaning the contract based protection is likely added vaguely to the (more specific) public policy based protection. Good faith based protection, on the other hand, shows a different picture, low correlations with other two (0.25 and 0.12) and its adoption rate has been low.

Since reforms happen at the state-level, we focus on their overall consequences, i.e., their impact on aggregate state-level or state-industry-level growth. By focusing on aggregate effects, we can be less concerned about reverse causality. This is more likely a problem for studies at the firm level, since job security at a firm is likely determined in part by profitability and other characteristics (e.g. indebtedness) of the firm (e.g., Bae, Kang, and Wang, 2011). Using US state- and state-industry-level data also overcomes some of the problems prevalent in cross-country studies where results can be driven by various country characteristics and other factors hard to control for.

B. State and State-Industry Growth Data

We use growth in state-level value added and in state-industry level value added to analyze the effects of changes in financial regulation and employment protection. The output growth data come from the US Bureau of Economic Analysis (BEA). Data cover the value-added produced in each state and state-industry combination. The industry breakdown is at the 2-digit SIC level with 63 industries at most per state, based on US SIC (rev. 2). We include all industries, including financial services, but also analyze separately non-financial industries. We use real growth rates, adjusted for national price (CPI) changes.[6]

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[5] Moreover, there are costs incurred in designing optimal labor contracts individually for every job, making standards protections useful.

[6] We use national prices for several reasons. For one, we want to be comparable with what Jayaratne and Strahan (1996) and other such studies do. Second, state-specific price indexes are available only from 1978 and using those would make our sample shorter and miss some important reforms. Also, reforms can affect the prices of non-tradable goods (e.g., land rents) because of productivity gains. Such state-specific price changes should be considered as part of the overall gains from reforms (see also Johnson et al. (2009) regarding PPP adjustments in cross-country growth studies). Note that we do not use TFP due to data availability issue at the state-industry level.

Data are available for all 50 US states and the District of Colombia, but following the literature, Delaware and South Dakota are dropped, as they allowed much more open financial systems early on in attempts to specialize in financial services. Altogether we have some 1,000 state level observations and 50,000 state-industry level observations. Table 1b shows that the average growth in value added is 2.4 percent, with a large variation. Note that, as we observe some clear outliers in the raw data, we take out observations with growth rates that are higher or lower than three standard deviations.

C. Industry Characteristics

To identify the channels by which judicial changes may affect firm performance, while avoiding potential simultaneity biases, we use the methodology of Rajan and Zingales (1998), who constructed the external finance tendency of each industry in the US. We create similar variables that measure the *natural* characteristics of knowledge intensity of each industry in the US using data from a different period. It is defined as the average use of intangible assets per fixed assets. This measure, like the external finance dependency, is constructed by taking the period mean of the median values for all firms in a specific industry for each of the years 1991 to 2006.[7] To check the robustness of our results to using this specific knowledge-intensity measure, we create two additional industry measures: the sales-to-fixed-asset ratio, similarly constructed from firm level data; and the fraction of college graduates in the workforce in that sector.[8]

Note that, although our theory refers to firm-specific human capital, no such data is readily available. Instead, we have to use human capital measures at the industry level, which are likely good proxies as industry- and firm-specific human capital needs are expected to highly correlated. This is the case, for example, when the firm-specific human capital refers to procedural knowledge and social networks important for white-collar workers that also have high industry-specific knowledge. Conversely, both industry- and firm-specific human capital are expected to be relatively low for industries that do not require high skills.

The correlations among these industry-level characteristics are as expected (Table 1c). The two knowledge dependence ratios, sales-to-fixed-asset ratio and intangible-to-fixed-asset ratio, are highly correlated, 0.71, suggesting that these two variables capture similar industry characteristics. Schooling has a correlation of 0.54 with the intangible asset ratio and 0.38 with the sales-to-fixed-asset ratio.

D. Regressions of Employment Protection on Growth

We start with state-level regressions, as they are comparable to existing literature. The state-level regressions use state-fixed effects to control for state-specific factors because initial income levels of each state and any other characteristics may affect state-specific growth trends. Job security in a specific year, for example, becomes de facto higher if the economy

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[7] The balance sheet variables are originally from the Worldscope firm level database, commercially provided by Thomson Reuters.

[8] This measure is taken from Buera and Kaboski (2012), who report the 2005 and 1940 data, which are highly correlated (more than 0.7), and we use their average. The industry classifications are different though from and often more detailed than those of US SIC (rev. 2). When there is an exact overlap with the SIC industry classification, we take the data as is. Otherwise we aggregate, using as weights the income share in the more detailed industry classifications for the period 1994-2000. We construct other variables similarly whenever necessary.

is booming. Since this can obscure the structural relation between job security and economic growth, we control for business cycle component by including year fixed effects. The exact specification for state *s* and year *t* is then:

$$g_{s,t} = \alpha_s + \alpha_t + \beta WorkRight_{s,t-1} + \epsilon_{s,t}. \quad (1)$$

where *WorkRight* denotes the degree of employment protection and we report robust t-statistics corrected for clustering at the state level.

We find that the employment protection has indeed insignificant effects on state-level growth (reported in the first column of Table 2), as shown by previous studies. We use the earliest of the three different labor reforms, which signals further coming employment protection and is often the public policy based protection. Regressions with each employment protection measure show similar results (report omitted).[9]

Using state-industry level regressions, we are more likely to detect the channels through which changes in employment protection affect output growth. We include state-industry fixed effects $\alpha_{s,j}$ to capture any state-specific industry growth trends. And we include state-year fixed effects $\alpha_{s,t}$ to control for other factors, such as state-specific business cycles and other policy changes. This use of dummies also means we only need to include interaction terms because the simple effects from financial deregulation or employment protection are already absorbed in the state-year fixed effects. The full specification for state *s*, industry *j*, and year *t* becomes:

$$g_{s,j,t} = \alpha_{s,j} + \alpha_{s,t} + \beta WorkRight_{s,t-1} * KnowledgeDep_j + \epsilon_{s,j,t}, \quad (2)$$

where *KnowledgeDep* denotes the industry's knowledge dependency, defined as the use of intangible assets relative to fixed assets. We use only the nonfinancial sectors in the state-industry level regressions and we report robust *t*-statistics corrected for clustering at the state level.[10]

The coefficient on the interaction term between the employment protection index and knowledge dependency is positive and statistically significant (Table 2, columns 2). We thus find support for our prediction that increased employment protection adds to growth in value added through an industry-specific, knowledge-related channel. The finding survives in various robustness checks (see Section V). Note that, as suggested by the state-level regressions, greater employment protection has little effect on overall economic activity but it helps growth of those industries that are more knowledge dependent. This also, however, implies that even basic employment protection adversely affects low knowledge intensive industries.

III. THEORY

A. Within-Period Contractual Model to Determine Productivity

The new empirical facts just shown in the previous section call for a new theory that explains positive effects of basic labor protection on economic growth. Theory should also be

[9] We also run the same regression using the non-financial sector only outputs. The regression results are almost identical (report omitted).

[10] We use `reg2hdfe` STATA command to estimate correctly regressions with two-dimensional fixed effects.

consistent with the existing literature that has shown negative growth effects of generous labor protection in Europe and Japan. We thus develop a theory to relate labor monopoly rights to growth with a view that monopoly rights can be considered as institutional environment, which affect economic development.

Given the nature of productivity, a standard growth model can be used to analyze the growth facts. And, the productivity itself can be separately analyzed by the within-period contractual problem, for example, in the spirit of Parente and Prescott (1999). We therefore focus on a within-period contractual model to determine the productivity—and later we present a dynamic general equilibrium extension of the model in the next section of this Theory section. Note that most consequences of labor frictions can be mitigated by perfect financial markets (e.g., perfect insurance for unemployment or wage cut). Hence, we need to assume some financial frictions, too. We thus simultaneously analyze labor and financial contracts, and we show how monopoly rights of workers and banks determine the productivity within a period.[11]

We assume that there exist a continuum of households, firms, and banks, with each having measure one. Firms and banks are assumed to be risk neutral. Below, we also assume a restriction on differential treatment of people, consistent with real world practices.

Assumption 1.
In case of debt restructuring, differential treatment of creditors is prohibited (i.e., pari-passu principle). In case of labor contract renegotiation, differential treatment of workers is allowed (e.g., layoffs of a subset of identical workers).

We assume a conventional production function: $y = \theta k^{1-\alpha}(hl)^{\alpha}$, where y denotes output, k capital, h firm-specific human capital per worker, l number of workers, and α a scaler taking a value between 0 and 1. We assume indivisible labor so that every worker provides either one unit of labor or zero. We also assume that without any training, the firm-specific human capital, h, is 0. The firm's productivity shock is denoted by θ, whose probability density function is f and cumulative distribution function is F with (normalized) mean $E[\theta]=1$. Note that the total factor productivity can be represented by θh^{α}, and hence the firm-specific investment directly translates into the total factor productivity.

The workers' period utility function is assumed to be $u(c)-v(h)$: households have positive utility from consumption but disutility from investing in human capital, while supplying (one unit of) labor inelastically. We assume the utility function to be twice-continuously differentiable and $u>0$ for $c>0$ and $u=0$ for $c=0$ with $u'>0$ and $u''<0$. The disutility of human capital investment follows typical assumptions, i.e., increasing and convex ($v' >0$, $v'' >0$).

Even if the true model is dynamic, we can omit the dynamic optimization problem and focus on within-period contractual problem. Indeed, it is shown to be the case in the next section, where, like a standard growth model, firms are assumed to be set up and shut down in each period and households maximize the discounted sum of period utility.

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[11] We focus on the implications of ex-post bargaining for the repayment of loans and layoff of workers, as influenced by the degrees of monopolistic power coming from employment protection and bank regulations. We abstract from any monopolistic market markups or credit rationing when loan contracts are made as well as from any non-market wage clearing or unemployment in the initial job market. These possibilities are discussed, however, in the later empirical section.

Within one period, the time line is divided into six subperiods as follows:

I. A (representative) firm hires $\hat{l}$ number of workers promising the wage w for one efficiency unit of labor hl (i.e., performance pay) and borrows capital at interest rate r from a (representative) bank, which has a fixed capital supply k.[12] The risk-free rate r_F is given and the capital k is immediately invested in the production facility.

II. Workers invest in firm-specific human capital h.

III. A firm (manager) observes a signal ρ about the productivity shock θ, to be realized in the penultimate subperiod, and reports it to its bank and workers. The signal is the best predictor of the shock, $E[\rho]=\theta$. For the sake of simplicity, we assume that the signal is exact, i.e., $\rho=\theta$.

IV. If it receives a bad signal, the firm may ask the banks to lower the repayment, but the firm manager has to prove the true state by paying (non-monetary) cost τ à la Townsend (1979). The firm may also fire $\hat{l}-l$ workers so that the number of workers who engage in production becomes l. Here, the firm manager also needs to pay a cost τ to prove the true state and to negotiate with each worker.[13] Note that, with a good signal, the firm would like to hire more high skill workers but cannot do so at this stage, because workers who are laid off from other firms (or the unemployed) do not possess the firm specific human capital, which is required for production.

V. Production takes place given a realization of the productivity shock θ drawn from probability density function f and cumulative density function F, which have bounded support $[\underline{\theta},\bar{\theta}]$. Each worker receives wh as promised if kept employed, and low income b otherwise by engaging in traditional productive activities that do not require high skills.[14] A firm pays whl to its workers. A bank receives rk, if a firm does not default; and otherwise the residual after wage payments, $y - whl$.[15]

VI. Each household consumes using its labor income, either wh or b.[16]

Note that the wage and interest rate are set at the beginning of period. As for the interest rate, this timing follows the tradition of costly state verification (Townsend, 1979). With non-monetary costs τ (e.g., extra work and psychological disutility) to verify the size of productivity shock and negotiate on layoffs, it is not optimal for a firm manager to prove all states. Instead, the firm wants to take the upside and repay constant due with a good shock, but is forced to pay costs to repay less with a bad signal. Hence, a debt contract becomes optimal with a prefixed interest rate. Although the interest rate r is the contracted one, all agents understand that there can be a distress situation, in which interest and principal are not repaid in full.

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[12] In the next section on dynamic general equilibrium, supply of capital becomes endogenous as the savings decision by households.

[13] Wage cut is also possible but not chosen—see Proposition 1 below.

[14] This could also be treated as an unemployment benefit.

[15] For the sake of simplicity, unless otherwise noted, the analysis deals only with the case in which productivity is high enough so that firm earnings after wage payments are always positive.

[16] Firm and bank profits can be considered to be allocated equally to each household. The profits, positive when the firm is solvent, are omitted here because the large number (continuum of agents) assumption makes the ownership share of each household (almost) zero. (See the more rigorous treatment in the general equilibrium section later.)

A worker is a stakeholder because she invests in firm-specific human capital *h* and needs to wait for the return on investment until production takes place. A fixed wage contract becomes the optimal contract for the same reason as for the debt contract with the bank. However, by Assumption 1, the firm (manager) can treat workers differently, unlike uniform (*pari passu*) treatment for creditors, and hence it faces a choice between layoffs and wage-cuts. Here, we would like to clarify the firm manager's objective.

Assumption 2.
A firm manager maximizes shareholder value of firm, net of his costs to verify the true state and to negotiate to lower wage and loan repayments from the promised amounts.

B. Market Equilibrium

The equilibrium decisions and outcomes can be found by solving the model backwardly, starting with subperiod V.

Subperiod V
In previous subperiod IV, Proposition 1 below shows that, with a low productivity signal, the firm manager choses layoffs to lower costs, rather than wage-cuts. Even with layoffs, however, the firm might not earn enough profits to repay the loan bill *rk* in full. It would then default and repay the residual to the bank in this subperiod V.

The number of workers *l* and wage *w* may be changed in subperiod IV but already fixed in subperiod V. Capital input *k* and promised gross interest rate *r* are given in subperiod I. Also, human capital *h* is determined in subperiod II. Given those variables, there is a unique threshold of productivity $\theta^*(l)$, below which the firm defaults (i.e., cannot repay the promised wage and interest in full) and above which it does not.

$$\theta^*(l) = \frac{rk + whl}{k^{1-\alpha}(hl)^{\alpha}}. \tag{3}$$

The income of a bank and a worker are explained below, together with the threshold signal in subperiod IV.

Subperiod IV
Signal ρ is received in previous subperiod III, and is the best (and assumed to be exact) predictor for future productivity θ. If the signal is good enough, $\rho \geq \rho^* = \theta^*(\hat{l})$, then there is no default and no worker layoff, i.e., $l = \hat{l}$. At the threshold, the firm is just able to pay both interest and wage payments in full—i.e.,

$$rk + wh\hat{l} = \hat{y}^*, \tag{4}$$

where $\hat{y}^*$ denotes the output with $l = \hat{l}$ and $\rho = \rho^*$.

If the signal is below the threshold $\rho < \rho^*$, the firm cannot repay the loan in full or keep the all workers. We now look into this case in detail.

Assumption 3.
The risk-free rate r_F is defined as the expected equilibrium return with full employment,[17]

$$r_F = E[MPK] = \int_{\underline{\theta}}^{\bar{\theta}} (1-\alpha)\theta k^{-\alpha}(h\hat{l})^{\alpha} f(\theta)d\theta. \tag{5}$$

Because the bank charges the same rate *r* at and above default threshold $\theta^*(\hat{l})$ and receives less than *r* below the default threshold, the bank needs to charge a rate higher than the marginal product of capital at the default threshold to compensate for the lower return when a bad productivity shock is realized. Therefore,

$$rk > (1-\alpha)\rho^* k^{1-\alpha}(h\hat{l})^{\alpha} = (1-\alpha)\hat{y}^* \text{ and hence } wh\hat{l} < \alpha\hat{y}^*. \tag{6}$$

If a bad signal is revealed (i.e., $\rho < \rho^*$), the firm manager offers a take-it-or-leave-it offer to banks and workers to maximize profits. However, the residual claims (for shareholders) after loan repayments and wage payments in this default region is zero, and hence, by Assumption 2, the firm manager just minimizes negotiation costs with workers (and banks).[18] Given *k*, *h*, and $\tilde{w}$,

$$\begin{aligned} &\min_{l^*,\tilde{w},1_w} \tau(\hat{l}-l^*) + 1_W \tau l^*, \\ &\text{subject to} \\ &l^*(\rho) = \arg\max \rho k^{1-\alpha}(hl)^{\alpha} - \tilde{w}hl. \end{aligned} \tag{7}$$

where 1_W is an indicator function, taking the value one if there is wage-cut (i.e., $\tilde{w} < w$) for remaining workers and zero otherwise.[19]

As the result of the minimization (7), the firm manager optimally chose the layoff of workers to the employment level $l^*(\rho)$ without wage-cut (i.e., $1_w = 0$). In other words, wage is kept at the initial level (i.e., $\tilde{w} = w$).

Proposition 1.
In distress, firms lay off workers without wage cut.

Proof
Suppose a firm lays off workers without wage cut. Then, the usual first order condition gives that, ex post, the optimal amount of labor is adjusted so as to equalize the marginal product of labor given the signal realized and the initial wage. That is,

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[17] This is not a necessary but sufficient condition. Theoretical results below are valid with a more relaxed assumption. Note that the interest rate is fully endogenized in the next section, which extends the model to a dynamic general equilibrium.

[18] With the bad signal, it is easy to show that the firm cannot honor the full loan repayment. The firm then needs to prove the true state also to the bank and to negotiate on repayments but, because of the *pari passu* principle (Assumption 1), there is no choice to alter the total cost τ regarding the bank loan restructuring. Therefore, the costs associated with loan renegotiation are omitted here.

[19] Note that the verification and negotiation costs here are assumed to be non-monetary costs (e.g., stressful, long hours of work) of the firm manager. However, all the results also go through with small monetary costs. If they were monetary costs, they would cause negative equity for firm shareholders. To avoid such a situation, these monetary costs would be charged to the banks and workers, as is often assumed in the literature.

$$l^*(\rho) = \frac{k}{h}\left(\frac{\alpha\rho}{w}\right)^{\frac{1}{1-\alpha}}. \tag{8}$$

This also means, in distress, given the initial wage and human capital level being determined in subperiod II, that the marginal product of efficient labor *hl** is equalized to the wage, while the repayment to capital holders *rk* is equal to the residual of output,

$$w = \left.\frac{\partial y}{\partial(hl)}\right|_{l=l^*,\rho=\rho^*} = \alpha\frac{y^*}{hl^*} \text{ and } (rk)|_{l=l^*,\rho=\rho^*} = (1-\alpha)y^*, \tag{9}$$

where y^* is output with reduced labor $l=l^*$ and at default threshold $\rho=\rho^*$.

Together with (6) we know that, at the threshold ρ^*, the bank gets repaid less with layoff,

$$(rk)|_{l=\hat{l},\rho=\rho^*} > (1-\alpha)\hat{y}^* > (rk)|_{l=l^*,\rho=\rho^*} = (1-\alpha)y^*. \tag{10}$$

Now consider a wage cut. Apparently, either layoff or wage cut would make the marginal product of effective labor equal to the wage rate in a case where the signal is lower than the threshold. However, the firm manager prefers layoffs in a financially distressed firm, even just below ρ^*. This is because he cannot honor promised payments to banks and workers and therefore he faces zero profit with either layoffs or wage cut. Yet, he needs to report the true state to, and negotiate with, affected creditors and workers by paying cost τ. To minimize total costs, it is best for the firm manager to deal with minimum number of workers, which can only be done through layoffs without any wage cut for retaining workers.

Q.E.D.

Note that, in the proof above, equation (10) means that the remaining capital income (and the output *y*) with full employment is higher than otherwise, and hence the bank would prefer a wage cut with full employment. But, the firm manager prefers layoff. This inefficiency result can be considered as a variant of the debt-overhang problem.

Once the layoff is chosen, the employment level maximizing the repayments to banks, *rk*, is exactly $l^*(\rho)$, which is the result of maximization of capital income (7). Therefore, there is a trade-off between workers who wants to be kept employed more than $l^*(\rho)$, and banks who wants to reduce the workforce to $l^*(\rho)$.

Now we introduce institutional constraints on firing workers. The institutional constraints on firing are obviously related to the legal restrictions on firing but also on bank monopoly rights. Once the firm manger decides layoff (rather than wage cut), banks also want to reduce the employment level to $l^*(\rho)$. Thus, bank monopoly rights also matter in determining the relative level of employment protection. That is, de facto protection should be less with stronger banks and weaker labor rules.

Assumption 3.
Relative strength of workers' monopoly rights against banks' monopoly rights create institutional restrictions on possible layoffs, resulting in firms retaining more than the number of profit-maximizing workers:

$$l_\lambda \equiv (1-\lambda) l^*(\rho^*; k, h, w) + \lambda \hat{l}, \tag{11}$$

where $\lambda \in [0,1]$ *represents the relative strength of monopoly rights of workers against banks.*

Corollary 1.
For all $\lambda \in [0,1)$*, a firm manager in a distressed firm chooses layoffs without a wage cut.*

Proof.
The case of $\lambda = 0$ is Proposition 1. For the case of $\lambda > 0$, the same logic holds. When the firm cannot repay the bank in full without cutting labor costs, the firm earns zero profit. The firm manager then would like just to minimize the verification and negotiation costs.

Q.E.D.

Subperiod III
Signal ρ is revealed. Note that, as discussed in subperiod IV, any bad signal lower than ρ^* will be truthfully reported by a firm manager to the bank and workers at the negotiations because it induces a firm to renege on its full repayments to the bank and workers and thus it will be verified by them.

Subperiod II

Each worker decides to invest in firm-specific human capital, taking into account the probability of layoffs in subperiod IV

Assumption 5.
Firms cannot know the level of human capital investment of each person before they engage in production. And, because they cannot identify who invested human capital more than others, firms fire workers randomly.

Under Assumption 5, the probability of a worker remaining employed is the same, $e = l_\lambda / \hat{l}$, for all the workers, where $l\lambda$ inside e is evaluated at $\bar{h}$, which is the other workers' choice of human capital on average. Then, the human capital investment decision is made by

$$\max_h \left(1 - F(\rho^*)\right) u(wh) + \left(\int_{\rho}^{\rho^*} e f(\rho) d\rho \right) u(wh) + \left(\int_{\rho}^{\rho^*} (1-e) f(\rho) d\rho \right) u(b) - v(h). \tag{12}$$

The first order condition is

$$v'(h) = B(\bar{h}) u'(c) w, \tag{13}$$

where

$$B(\bar{h}) \equiv 1 - F(\rho^*) + \int_{\underline{\rho}}^{\rho^*} e f(\rho) d\rho. \tag{14}$$

Here, both ρ^* and e are evaluated at $\bar{h}$, the average level of (other workers') human capital investment. In equilibrium, the personally optimal choice of human capital investment h^* must be the same as the average level (i.e., a typical fixed point condition):

$$h^* = \bar{h}. \tag{15}$$

Given such (average) human-capital investment, firms decide how many workers they retain. Here, $B(\bar{h})$ represents the extensive margin of benefits from human capital investment. It consists of a change in the default threshold in the optimal loan contract due to an increase in the level of average human capital.

If *B'(h)* is not zero, then there is an externality. In this case, the decentralized decision for optimal human capital investment is not necessarily unique or (constrained) socially optimal. For a social planner, a similar first order condition can be written, but since she internalizes the externality, she solves the following first order condition,

$$v'(h) = B(h)u'(wh)w + B'(h)u(wh). \tag{16}$$

The left-hand side of (16) is increasing in human capital investment *h* as *v'>0* and *v">0*. The first term in the right-hand side of (16), given all other things equal, is decreasing in *h* as *u'*>0 and *u''*<0. The second term does not appear in the decentralized version (13). If *B'(h)* is negative or zero, then the socially optimal firm-specific human capital level *h** is still uniquely determined. If it is positive, then uniqueness of the social optimum is not guaranteed. As for the decentralized decision, in general, if *B'(h)* is not zero, there can exist multiple equilibria that satisfy the fixed point condition (15). For the sake of simplicity, we assume the following:

Assumption 6.
There is no externality in investing human capital, $B'(h) = 0$.

Appendix I provides the condition that makes this assumption hold. Note, however, that we do not say the condition is general but rather, with Assumption 6, we would like to focus on the key mechanism other than the externality.

Proposition 2.
Given w, r, $\hat{l}$, *k, and λ, the workers determine their optimal human capital investment level h* uniquely under Assumptions 1 – 6.*

The proof is provided in Appendix II.

Cororally 2.
The equilibrium firm-specific investment h increases with higher capital inputs k and with higher relative monopoly rights of workers λ, but deceases with higher initial number of workers* $\hat{l}$.

The proof is provided in Appendix III.

The effect of a higher wage is not so clear. Higher wage lowers *l** (and thus l_λ) because a firm would like to lay off more workers. Moreover, there is an additional effect through *u'(wh)w*, the marginal utility gain from additional human capital investment. If this increases with a higher wage, human capital investment could increase; otherwise, it could decrease.

This relation turns out to depend on the wealth effect, for which we make the following often-made assumption in macroeconomic literature.

Assumption 7.
Relative risk aversion is higher than or equal to one.

Proposition 3.
Under Assumptions 1 – 7, a higher wage reduces the human capital investment under small verification and negotiation costs τ.

The proof is provided in Appendix IV.

Subperiod I:

Labor demand is determined by a (representative) firm, while labor supply is assumed to be inelastic, one unit, and indivisible. The firm manager's problem in subperiod I is (under Assumption 2) to maximize the (expected) shareholder value net of his (expected) non-monetary cost by choosing the capital and initial labor inputs given interest r and wage w:[20]

$$\max_{k,\hat{l}} \int_{\rho^*}^{\bar{\rho}} \left(\rho k^{1-\alpha} (h^* \hat{l})^{\alpha} - w h^* \hat{l} - rk \right) f(\rho) d\rho - \tau F(\rho^*), \tag{17}$$

subject to the arbitrage-free condition for the banks regarding risky return r, given risk-free rate r_F:

$$r_F k = \int_{\rho^*}^{\bar{\rho}} rkf(\rho) d\rho + \int_{\underline{\rho}}^{\rho^*} \left(\rho k^{1-\alpha} (h l_\lambda)^{\alpha} - w h^* l_\lambda \right) f(\rho) d\rho. \tag{18}$$

Note that this is also the bank's participation constraint. Given available funding from the rest of the world, each bank is assumed to provide funding until the arbitrage condition is met. In equilibrium, capital demand is equal to the pre-fixed capital endowment. By the way, we can allow for some markups on the left-hand side of (18), i.e., some ex-ante monopolistic power, and still preserve all our comparative results. The presence of such a markup and its changes have been extensively studied, including how they affect capital allocation and growth, and our model provides no specific new insights. Hence, instead, we focus on bank's ex-post monopoly power—i.e., when negotiating a distressed firm's repayment plan that can involve worker layoffs.

We then solve this firm value maximization problem to determine the capital demand and the initial labor demand, by substituting the arbitrage-free condition for banks into the shareholders' value maximization problem (net of firm manager's costs):

$$\max_{k,\hat{l}} \int_{\rho^*}^{\bar{\rho}} \left(\rho k^{1-\alpha} (h^* \hat{l})^{\alpha} - w h^* \hat{l} \right) f(\rho) d\rho + \int_{\underline{\rho}}^{\rho^*} \left(\rho k^{1-\alpha} (h l_\lambda)^{\alpha} - w h^* l_\lambda - \tau \right) f(\rho) d\rho - r_F k. \tag{19}$$

[20] The level of production is affected by the realization of the shock θ itself, but the layoff decision is made right after the realization of signal ρ, so that the probability weights are calculated based on the distribution $f(\rho)$ (as ρ is the best predictor for θ, the expected output can be written with ρ replacing θ).

The arbitrage condition can be also written as $r = r_F$ + *risk premium*. The firm should recognize the feedback effects of its own labor and capital input decisions on the risk premium. The first order condition with respect to capital then provides the capital demand function for a given risk-free interest rate (which is endogenized in the dynamic general equilibrium version in the next section).

The first order condition with respect to hiring $\hat{l}$ is

$$\Psi_1 \int_{\rho^*(\hat{l})}^{\bar{\rho}} (MPL_1 - w) f(\rho) d\rho + \int_{\underline{\rho}}^{\rho^*(\hat{l})} \Psi_2 (MPL_2 - w) f(\rho) d\rho = 0, \tag{20}$$

where

$$\psi_1 = h^* + \hat{l} \frac{\partial h^*}{\partial \hat{l}},\ \psi_2 = h^* \frac{\partial l_\lambda}{\partial \hat{l}} + l_\lambda \frac{\partial h^*}{\partial \hat{l}},\ MPL_1 = \rho \alpha k^{1-\alpha} (h^* \hat{l})^{\alpha-1}, \text{ and } MPL_2 = \rho \alpha k^{1-\alpha} (h^* l_\lambda)^{\alpha-1}. \tag{21}$$

The firm employs more workers on average in the first stage than strictly needed in production because there will be no more skilled labor available even if it receives a good shock. It is better to hire some extra workers at the first stage, train them, and fire them if the productivity shock is low. Technically, the firm has to take into account that the firing threshold ρ^* depends on the number of initial workers $\hat{l}$. This extensive margin is represented by below (20), but we can ignore it for small cost τ.

$$-\left(\rho^* k^{1-\alpha} (h^* \hat{l})^{\alpha} - w h^* \hat{l}\right) f(\rho^*) \frac{\partial \rho^*}{\partial \hat{l}} + \left(\rho^* k^{1-\alpha} (h^* l_\lambda)^{\alpha} - w h^* l_\lambda - \tau\right) f(\rho^*) \frac{\partial \rho^*}{\partial \hat{l}} < 0. \tag{22}$$

The first term is the cost of keeping all the initial workers at the default threshold, while the second term is the benefit of firing workers at the same threshold. Based on equation (10), this sum is negative, but it apparently approaches zero with smaller verification and negotiation cost τ.

If a firm fully commits not to lay off any workers, or if workers possess high bargaining power, then the condition (20) above can be represented as the limit of $\lambda \to 1$. In this case, $l_\lambda \to \hat{l}$ (i.e., $\Psi_2 \to \Psi_1$ and $MPL_2 \to MPL_1$).[21] Then (20) becomes simply $\psi_1 \left(E[MPL_1] - w\right) = 0$, i.e., the expected profit becomes zero, if $\lambda=1$,

$$\int_{\underline{\rho}}^{\bar{\rho}} MPL_1 f(\rho) d\rho = E[MPL_1] = w. \tag{23}$$

A similar equation is satisfied if $\lambda=0$. But, in this case, by definition, the ex-post marginal product of labor in distress situations (MPL_2) becomes equal to wage w for every realization of ρ below threshold ρ^*. Therefore, the second term in (20) is zero and hence the first term, the expected returns for only the good states of the world, should be equal to the wage, i.e., if $\lambda=0$,

[21] The threshold level of signal ρ^* for the firm to honor promises becomes lower with higher employment protection λ. With $\lambda=1$, the firm cannot fire workers and the threshold level of signal ρ^* refers only to the loan repayment negotiation.

$$\int_{\rho^*}^{\bar{\rho}} MPL_1 f(\rho) d\rho = w. \quad (24)$$

In between the two cases, i.e., $0<\lambda<1$, even with low realization of ρ, the firm by construction cannot fire workers as much as it wants. Note again that, given the fixed capital endowment k, full employment in the initial period $\hat{l} = 1$ determines the equilibrium wage, which we denote w_1 for $\lambda=1$ case, w_0 for $\lambda=0$ case, and w_λ in general.

Proposition 4.
The equilibrium wage, w_λ, is uniquely determined for small τ, given the relative bargaining power λ of workers, banks' initial capital endowment k, inelastic labor supply at one, and the financial contract represented by (r, ρ^*).

Proof is provided in Appendix V.

The unemployment rate for initial labor hiring might not be zero if the prevailed wage is higher than the equilibrium wage w_λ. This could happen due to minimum wage laws or collective bargaining on wage with labor unions. A non-equilibrium high wage is clearly detrimental for macroeconomic outcomes. We do not explicitly analyze this theoretically, but note that the negative effects from ex-ante bargaining on wage are different from the effects of ex-post negotiation on employment. We look into non-equilibrium wage issue later with additional empirical analysis.

Lastly, we can also characterize the optimal capital input decision and equilibrium in the capital market.

Proposition 5.
The equilibrium interest rate, r, and the default threshold, ρ^*, are uniquely determined, given the risk-free rate r_F, relative monopoly rights λ of workers, banks' initial capital endowment k, and inelastic labor supply of one.

Proof is provided in Appendix VI.

Note that the result holds even in cases in which Assumption 3 is slightly violated, i.e., the risk-free rate can differ from the unconditional expected return described in Assumption 3. If the risk-free rate is low, then there will be more excess profits for the firm owners. In standard neo-classical models, the sum of the interest paid to banks and this excess return constitutes the return to capital, which, given an initial capital amount, is endogenously determined. In this model, the bank, as an outside investor, is arbitraging with the risk-free rate, while the firm owners receive any excess returns without being able to arbitrage with the outside world. Therefore, the risk-free rate becomes the free parameter that divides the return between the bank and the firm owners. Consequently, Assumption 3 implies that with small cost τ, all the expected capital returns essentially go to the bank. Note again, however, that risk-free rate is endogenized in the dynamic general equilibrium version in the next section.

C. Time Inconsistency Problem

So far, we assumed by Assumption 4 that λ, the relative monopoly rights of workers, is institutionally determined. Now, we consider what would happen if the firm can also choose the level of workers' relative power. Because there is a tradeoff between incentivizing

workers to accumulate firm specific human capital and lowering ex-post efficient production level, the firm may want to choose the optimal level of employment protection. Below, we find that this is the case.

Proposition 6.
If a firm can commit a specific level of workers' rights, under Assumptions 1 – 7, then in general there exists workers' relative monopoly rights λ^*, $0<\lambda^*<1$, which maximize firm's profits, at least locally. It satisfies the following condition with equilibrium wage w and interest rate r (as determined in Propositions 4 and 5):

$$0 = \int_{\underline{\rho}}^{\rho^*} \left(MPL_2 - w \right) l^* f(\rho) d\rho. \quad (25)$$

The proof is provided in Appendix VII.

Corollary 6.
Multiple λ can be equilibria. In particular, both $\lambda=0$ and $\lambda=1$ *are equilibria. For internal solutions, equilibrium wage w_λ is lower with higher worker rights.*

The proof is provided in Appendix VIII.

Note that for any *r* and *w*, several λ may satisfy condition (25). However, for a set of (r, w, λ) to be an equilibrium, condition (25) needs to be simultaneously satisfied with the conditions for equilibrium wage and interest rate as defined in Propositions 4 and 5. And, even then, multiple equilibria can exist. Which equilibrium is most desirable for the firm depends on the trade-off between human capital accumulation and the flexibility of firing workers. An analytical solution is difficult to obtain.

However, as long as this trade-off is important, some internal solution, $0<\lambda^*<1$, that is the best for the firm (i.e., firm managers, shareholders, and creditors) should arise. This implies an inverted-U shaped relationship between workers' bargaining power λ and firm profits as shown in Figure 2.[22] Moreover, by construction, the profit-maximizing level of worker rights depends positively on the degree to which high skills are demanded in the firm or industry.

Proposition 6 therefore states that there is a workers' relative power λ^* that maximizes firm profits. But, there is a time inconsistency problem: the firm cannot commit ex ante not to lay off some workers. That is, ex post, the optimal choice by the manager of a distressed firm (i.e., the subgame perfect equilibrium) is $\lambda=0$, as shown in the analysis for subperiod IV. Then, knowing that they could be laid off easily, workers choose to invest less than the profit-maximizing level of human capital. Hence, a public intervention can be useful: Legal restrictions on firing can be the commitment device for firms not to lay off workers at their free will in case of a bad shock.

[22] If mixed strategies (or lotteries) were allowed, the profit frontier would always become convex as depicted in Figure 1.

D. Social Optimum in Allocating Labor

We focus on how the time inconsistency problems can be mitigated by laws and regulations. However, if there are externalities present, there will be additional scope for laws and regulations to improve social welfare. Obviously, such arguments are quite standard and we do not want to emphasize such externality-based arguments here. Assumption 5 has already purged one externality stemming from potential dependence of the unemployment rate on other workers' human capital investments. Here, even under Assumption 5, a question arises whether the workers' monopoly rights λ^* that is privately optimal for the firm is also (constrained) social optimum. Indeed, there may exist another externality regarding allocation of workers between the firm sector and the traditional sector.

To compare with the social planner's problem, we slightly modify the institutional setup of the economy along with the macroeconomic literature, and closer towards the general equilibrium version—that is, we now explicitly assume that household consumption is insured against labor income, either *wh* or *b*, by lump-sum transfers. We also assume that the firm profits and bank profits (i.e., returns to capital) are shared equally among households.

Since the set-up is quite standard in the macroeconomic literature, it is easy to show that these modifications do not alter the competitive equilibrium results, except that consumption is now equalized across states thanks to the risk sharing. More formal treatment is given in the next section, but here is the sketch. Given λ, the competitive equilibrium with risk sharing is the (constrained) social optimum. The (constrained) social planner maximizes the representative household utility, $u(c) - v(l)$, subject to the firm profit maximization (18), the bank participation constraint (19), the worker participation constraint, $w \geq b$, and the resource constraint, $c = y$. All the first order conditions are equal to those in the market equilibrium when the social planner is also constrained by the informational problem with the same costs to verify the state and negotiate the contracts and also with exogenously imposed relative monopoly rights λ of workers. Therefore, the constrained socially optimal allocation coincides with the competitive equilibrium outcome (similar to the arguments by Townsend, 1979).

When the worker right λ is endogenously chosen by firms in the competitive equilibrium and by the social planner in the social planning problem, the choices of λ by firms who cannot commit, by firms who can commit, and by the social planner (who can commit) are all different. The difference between the first two cases are the result of the time consistency problem, which is already discussed in the previous section. Below, then, we explain the different choice of λ by firms who can commit and the social planner who can commit.

The difference between the social optimum and the decentralized equilibrium stems from the fact that the social planner maximizes the overall output while the firm manager maximizes only the firm value net of his costs. In distress, only the social planner cares about the best utilization of the fired workers in the traditional sector with production level *bl*.[23] From the

[23] Note that, if λ is fixed, the same argument might cause a disparity between the competitive equilibrium and the constrained social optimum. However, this disparity does not exist in our model because in the competitive equilibrium $w \geq b$ is taken care of as the participation constraint, which always holds in equilibrium, with layoffs that support the equilibrium wage higher than *b*. And, the constrained social planner cannot improve any ex-post inefficiency with any $\lambda > 0$, as it also needs to obey the institutional constraints represented by λ. Therefore, the disparity between the competitive equilibrium and the constrained social optimum could exist only when worker power λ is also a choice variable by the firm and by the social planner.

social planner's point of view, there can thus be socially wasteful firing. In this case, workers with high skill can produce more if they are retained in the firm. On the other hand, there can be socially wasteful retention with excessive employment protection. With higher λ, workers try to keep their high paid job even when things turn bad and the firm faces difficulties paying the promised wage without defaulting on its creditors. In this case, it would be socially better if workers change jobs to the traditional sector that offer certain, albeit lower income.

Because worker right λ is chosen before the productivy shock arises (or indicated by the signal), specific λ may ex post induce either socially wasteful firing or retention depending on the shock. Let $\hat{\rho}$ denote the threshold of the realization of the productivity shock when neither wasteful firing nor retention occurs. Socially destructive firing occurs when the ex-post marginal productivity of labor at the firm is higher than the traditional sector return *b*. Note that this threshold is likely equal to the lower bound of threshold ρ^* for λ close to zero, because the safe, low return *b* is assumed to be less than the expected marginal product of labor in the high skill sector under full employment.

The expected loss from socially destructive firing is,

$$\int_{\hat{\rho}}^{\rho^*} (\hat{l} - l_\lambda)(h^* MPL_2 - b) f(\rho) d\rho. \tag{26}$$

The opposite case is socially destructive retention, which has an expected loss

$$\int_{\underline{\rho}}^{\hat{\rho}} l_\lambda (b - h^* MPL_2) f(\rho) d\rho. \tag{27}$$

The net expected social loss from sub-optimal firing-retention decisions by the firm is the sum of the two.

Proposition 7.
The socially optimal level of worker power λ^{SP} is neither zero nor one. Also, in general it is not equal to the internal solution λ^* for firms that can commit, except for the case that having the societal loss from firing equates to avoiding the societal loss by retention:

$$\int_{\hat{\rho}}^{\rho^*} \hat{l}(h^* MPL_2 - b) f(\rho) d\rho = \int_{\underline{\rho}}^{\rho^*} l_\lambda (h^* MPL_2 - b) f(\rho) d\rho. \tag{28}$$

with $\hat{l} = 1$.

The proof is provided in Appendix IX.

The disparity between the social optimum and the decentralized equilibrium could serve as an additional argument for government intervention. The direction of this disparity is not obvious in general and we refrain from further investigation in this paper. However, in a special case of *b=0*, only socially destructive firing (26) can occur. Therefore, when *b* is

small, socially optimal worker right λ^{SP} is likely larger than the competitive equilibrium λ^{*} chosen by the firms who can commit.[24]

IV. DYNAMIC GENERAL EQUILIBRIUM

We now extend the one-period model to a dynamic model. By doing so, savings and thus supply of capital becomes endogenous, and so does the interest rate, determined in the general equilibrium. However, we also show here that the key mechanisms and predictions of the one-period model remain intact.

As in much of the macroeconomic literature, we assume that firms are set up at the beginning of each period and shut down at the end of each period. And, therefore, demand (by firms) for labor and capital is by construction the same as in the within-period problem described in the previous section.

A continuum of households, with measure one, is assumed to live infinitely. A household maximizes the discounted sum of utility over time. Capital is owned by households and is rented to banks at the beginning of each period. The ownership of firms and banks is assumed to be equally distributed among households. At the end of subperiod VI, the household labor income is determined, depending on employment status. However, as is often assumed in the macroeconomic literature, we also assume that labor income risk is insured by lump-sum transfers among households. Moreover, capital income is also determined in subperiod VI, which is non-stochastic due to risk diversification. Finally, at the end of each period (i.e., additional subperiod VII), a household decides its savings, which are equal to investment *i*.

For the employed, the budget constraint with the income after lump-sum transfer is

$$c_V + i_V = rk + whl + \psi\pi - x, \tag{29}$$

where π is the profit of market portfolio (i.e., all firms and banks), ψ is the (equal) ownership share of the market portfolio, and x is the lump-sum tax (i.e., premium) for labor income risk insurance. For a fired person, the budget constraint with the income after transfer is

$$c_W + i_W = rk + bl + \psi\pi - x + T, \tag{30}$$

where T is the lump-sum transfer (i.e., insurance payment) for labor income risk insurance. The economy-wide resource constraint is

$$x = (1-e)T = (1-e)(w\bar{h} - b). \tag{31}$$

For given k, next-period capital potentially depends on the employment status, that is,

$$k'_V = (1-\delta)k + i_V \text{ and } k'_W = (1-\delta)k + i_W \tag{32}$$

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[24] Note that *b*, which is income obtained outside of firms, could be considered unemployment benefits, rather than outputs of the traditional sector. In this case, because the unemployment benefits need to be funded by taxes, which may be distortionary, there would be additional reasons to avoid firing from the social planner's point of view. This is the same argument as in Blanchard and Tirole (2008), though explained in a quite different model.

for the employed and the fired, respectively, where k'_V denotes the next-period capital for a worker who is kept employed in this period and k'_W denotes that for a worker who is fired in this period.

The continuum of firms with measure one without aggregate uncertainty implies that the fluctuating return from each firm due to default is pooled and therefore the equilibrium risk free rate is given by (18). In other words, (18) is the arbitrage condition for banks in the within-period partial equilibrium, but it is also the fixed point condition of the general equilibrium.

Investment decision is made at the end of each period (subperiod VII), after human capital investment decision is already made. Therefore, given the price sequence $\{r_{Ft}, w_t\}_{t=1}^{\infty}$, an employed person, with specific capital *k* and human capital *h*, faces the decision of investment at subperiod VII as follows

$$V(k,h) = \max_{k'} u(c_V) - v(h) + \beta Z(k'_V), \tag{33}$$

and a fired worker with the same *k* and *h* faces

$$W(k,h) = \max_{k'} u(c_W) - v(h) + \beta Z(k'_W), \tag{34}$$

where *Z(k)* is the value at subperiod II when a household decides on human capital investment

$$Z(k) = \max_{h} eV(k,h) + (1-e)W(k,h), \tag{35}$$

or equivalently,

$$Z(k) = \max_{h} e\{u(c_V) - v(h) + \beta Z(k'_V)\} + (1-e)\{u(c_W) - v(h) + \beta Z(k'_W)\}, \tag{36}$$

Note that, as discussed already, when deciding the human capital investment, a worker does not know yet if he would be kept employed or fired. Moreover, because the price sequence of *r* and *w* depends on aggregate human and physical capital, but not person specific *k* and *h*, personal decision on human capital *h* would not affect the personal decision of the next period capital *k'* directly. Therefore, the first order conditions for deciding human capital *h* depends only on the level of consumption when kept employed,

$$v'(h) = B(\bar{h})u'(c_V)w, \tag{37}$$

which is exactly the same as (13), the first order condition of the within-period problem. In other words, the personally optimal decision of human capital investment is not affected by the dynamic part of the model.

Given the optimal choice of human capital investment *h*, the optimal choice of physical capital investment is then determined by the Euler equations. By solving the value functions for the employed and the fired separately, we obtain the Euler equation for each.

The first order conditions are

$$u'(c_V) = \beta Z'(k'_V) \text{ and } u'(c_W) = \beta Z'(k'_W) \quad (38)$$

for the employed and the fired, respectively.

The envelope theorem implies

$$V'(k) = \left(r_F + 1 - \delta\right)u'(c) \text{ and } W'(k) = \left(r_F + 1 - \delta\right)u'(c). \quad (39)$$

Moreover,

$$Z'(k) = eV'(k) + (1-e)W'(k). \quad (40)$$

Then, the Euler equations becomes

$$u'(c_V) = \beta\left(r_F + 1 - \delta\right)\left\{eu(c'_{VV}) + (1-e)u(c'_{VW})\right\} \quad (41)$$

and

$$u'(c_W) = \beta\left(r_F + 1 - \delta\right)\left\{eu(c'_{WV}) + (1-e)u(c'_{WW})\right\}, \quad (42)$$

where subscript VV denoting the situation that she is kept employed both in this period and the next period, VW denoting that she is kept employed in this period but fired next period, and so forth. For the sake of simplicity, we assume CRRA utility, $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$.

Proposition 8.
Because of income insurance, given same current capital k, consumption and next-period capital are not affected by the employment status, i.e., $c_V = c_W = c \text{ and } k'_V = k'_W = k'$.

Proof.
Suppose current-period consumption is higher for the employed than the fired, i.e., $c_V > c_W$. Then, because of the income insurance, next period capital is lower if more is consumed today, i.e., $k'_V < k'_W$. The next period consumption when employed in the next period, c'_{VV} and c'_{VW} should follow the same consumption-savings decision in the next period, except for the possibly different level of capital income rk'_V and rk'_W in the next period. This implies $c'_{VV} < c'_{WV}$, because consumption and savings are strictly increasing functions of capital in a typical simple growth framework like this paper. Similarly, so is $c'_{VW} < c'_{WW}$. This implies two Euler equations (41) and (42) cannot be true at the same time. This is a contradiction and hence $c_V = c_W$, implying also that $k'_V = k'_W$.

Q.E.D.

Because $c_V = c_W$, there is no fluctuation in consumption depending on employment status. In other words, by eliminating income risks with income insurance at the end of subsection VI, in subsection VII and (next-period) subsection I, households become identical. Then, all households can be represented by one typical household. The Euler equation for the representative household becomes simply the following

$$u'(c) = \beta\left(r_F + 1 - \delta\right)u(c'), \tag{43}$$

and with the CRRA utility,

$$\frac{c'}{c} = \left\{\beta\left(r_F + 1 - \delta\right)\right\}^{\frac{1}{\sigma}} \tag{44}$$

This determines the consumption growth of the representative household and thus the output growth.

Proposition 9.
Institutional reforms that induce higher human capital will result in higher output growth, at least for some periods.

Proof.
Because the underlying model follows the Cass-Koopmans model, the steady state growth is dictated by population growth, which is assumed to be zero in this paper, and by the TFP growth. Because we assume a Cobb-Douglas production function, the total factor productivity can be represented by θh^{α}. Therefore, the productivity growth is dictated by the increase in human capital investment *h*. Although the steady state growth rate in the long run is the same for any given level of human capital as in a typical Cass-Koopmans model, any institutional reforms that induce higher human capital *h* should boost the growth rate in transitions to the long-run steady state.

Q.E.D.

An important empirical question is, therefore, to find out if there is different growth rate after institutional changes regarding the monopoly rights of workers and banks.

V. EMPIRICAL INVESTIGATIONS INCLUDING BANK MONOPOLY RIGHTS

Our model's key prediction is that there can be positive effects on economic growth by introduction of basic employment protection, but the effects become negative with generous protection, showing an inverted-U shaped relation. Moreover, what matters is not the absolute level but the relative strength of worker monopoly rights against creditors when splitting the outputs of a distressed firm. Therefore, bank monopoly rights interact with labor monopoly rights in determining productivity. This contrasts with most other theories which do not suggest any effect on economic performance from the interactions between financial and employment protection reforms.[25]

[25] The bank deregulation literature has so far, explicitly or implicitly, focused on the effects of banks' ex-ante monopolistic behavior on credit allocations. A reduction in monopolistic rents then leads to more loans being extended and resources being better allocated among firms, resulting in higher economic growth. But, this channel has no predictions on the interactions between financial liberalization and employment protection reforms. Another possibility is that job security was higher before financial deregulation if less competitive banks kept inefficient firms afloat (e.g., zombie firms). In this theory, however, with more inefficient firms, firm-specific human capital investment would decline with financial deregulation and aggregate value-added would not grow faster due to this channel. An exception is Perotti and Spier (1993) who argue that less powerful creditors may extend loans or agree to reschedule repayments so that workers can keep their wage or job.

In reality, firms' dependence on (firm-specific) knowledge may differ, at least across industries. Naturally, then, growth effects from reforms may also vary among industries. Our model can incorporate the industry-level effects in two ways. First, it is just an interpretation of the model already explained. While one type of industry requires firms-specific human capital investment and pays wage *whl*, another type of industry does not and offers only low-skill daily jobs that pay *bl*. We have already explored the implication of this model. There is an inverted-U shaped relation between relative monopoly rights of workers and profits of the knowledge dependent high-skill sector. However, any increase in worker rights λ in the high-skill sector reduces the number of workers in the low-skill sector and thus its outputs.[26].

Second, two sectors that differ in the utilization of human capital can be introduced in addition to the low-skill daily job sector. For example, we can add a second industry with the production function $y = \theta k^{1-\alpha}(\gamma hl)^{\alpha}$ with $0 < \gamma < 1$ representing the degree of knowledge dependency—while the first industry has $\gamma = 1$, implicitly. Given the economy-wide wage and interest rate, it is easy to show that the peak of an inverted-U shaped relation between worker rights and firm profits is closer to zero for the second industry having lower knowledge dependency γ. In other words, even an small increase in worker rights is likely negative for industries with low knowledge dependency.

Another industry characteristic that may matter for our theory is external finance dependence. While all capital has been so far assumed to be financed through banks, again in reality, capital is partly provided internally. We could incorporate such internal funding, too. Recall that the firm manager needs to pay verification and negotiation costs in distress. However, by having internal funding, the threshold signal level becomes lower, saving such costs. Of course, by having internal funding, the firm manager-owner would face less risk diversification, creating another kind of utility cost for the firm manager-owner. This means that, depending on, for example, the size of variance of productivity shocks, industries may differ in degree of internal funding. Put differently, industries with more internal funding (i.e., less external finance dependence) would be affected less by any effects from worker rights in our theory.

A. Data for Bank Monopoly Rights

Because our theory predicts interaction effects between labor and creditor monopoly rights, we now try to find if such an effect is observed in the data, especially in the context of the U.S. experience. Specifically, Jayaratne and Strahan (1996) describe the history of bank branch deregulation in the US. Before the deregulation, unit banking was the rule: a bank could operate at its headquarters' location only and could not open any branch. Starting in the early 1970s (except for some states), banks were allowed to operate multiple branches within each state (intrastate banking), first through mergers and acquisitions of other banks, and then by establishing new branches (*de novo* branching). This deregulation took place at different times in each state, with large variations. Finally, in 1994, the federal government permitted banks to operate branches in different states (interstate banking). The degree of banks'

[26] Suppose wages (and interest rates) are the same before and after an increase of worker rights λ. Then, because the threshold signal is at the same level, higher worker rights mean less fired workers by construction, and thus less people engaging in the low-skill sector. Moreover, the equilibrium wage with higher worker rights is lower (Corollary 6), implying a lower threshold signal and even less firing.

monopoly power, as previous studies have shown, is considered as inversely associated with the degree of this deregulation.[27]

The effect of greater bank competition itself on economic growth can be expected to be positive. It has been found to be so, in particular, in the U.S. context based on the evidence of bank branch deregulation between 1970s and 1990s (Jayaratne and Strahan, 1996). Theoretically, several channels can be considered and some have been empirically tested. The first one is the enhancement of efficiency in the banking sector: Stiroh and Strahan (2003), for example, show evidence for a competitive shake out of inefficient banks following deregulation. Moreover, Black and Strahan (2001) show that the female share of managerial position increased after deregulation, suggesting that bank owners and employees had enjoyed rents that dissipated after deregulation. The second channel is through a more efficient allocation of credit among firms, identified in many theoretical and empirical studies using US as well international data (e.g., Abiad, Oomes, and Ueda, 2008; Acharya, Imbs, and Sturgess, 2011; Ueda, 2013). A related channel is through better forms of risk taking by firms (Boyd and De Nicolo, 2005).[28]

The data we use on bank branch deregulation comes from Jayaratne and Strahan (1996). Specifically, the financial deregulation index we use defines deregulation in one of two ways: *FinLib = M&A*, which is a dummy equal to 0 when bank branch through M&A is restricted, and 1 if it is deregulated; or *FinLib = de novo* which is a dummy equal to 0 when bank branch is restricted, and 1 if it is deregulated. For robustness, we investigate the effects of both measures, but since M&A bank deregulation always precedes de novo deregulation, we find, not surprisingly, most impacts from M&A bank deregulation and only report those results. Figure 3 depicts the number of states that have allowed mergers and acquisitions (M&A) or *de novo* branches.

Figure 3 shows the accelerating trend of financial deregulation between the 1970s and the 1990s. Changes in bank monopoly rights and employment protection did not occur at the same time, though, in each state. Figures 4a and 4b depict the number of years between financial deregulation and changes in employment protection at the individual state level. It is clear that the two policy changes occurred in some states at quite different points in time as the number of years between financial deregulation and changes in employment protection varies from minus 20 to plus 20.

Table 1b provides some further indication of the (lack of) overlaps in two stakeholders' monopoly rights by showing the raw correlations between the various indexes. It shows a strong correlation between the two financial deregulation indexes (*M&A* and *de novo*), a correlation of 0.79. Importantly, most correlations between financial deregulation and employment protection indexes are low, between 0.14 and 0.29, reflecting the substantial variation when these two types of reforms were adopted in each state.

As for the industry characteristics, we now looked at additional characteristics, the so-called external finance dependence (Rajan and Zingales, 1998), which is the ratio of investment

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[27] See Strahan (2003) for a review on the economic effects of US banking deregulation.

[28] This has been debated because theoretically, in a second-best world, less bank competition could reduce bank excess risk taking (Allen and Gale, 2004) and lead banks to expand lending and enhance overall output (Hellmann, et al., 1996).

minus internal cash-flows from operations to capital investments.[29] Table 1c shows that the correlation between external finance dependence and intangible-to-fixed-asset ratio is a negative 0.44, i.e., more external financial dependent firms use more fixed assets to produce their output. Similarly, the external finance dependence and sales-to-fixed-asset ratios have a negative correlation of 0.52. Correlation with the fraction of college graduates is low, negative 0.12. Overall, knowledge intensity and external finance dependence can be considered as negatively correlated, at least slightly.

B. Interaction Effects in Regressions

Our model suggests that ex-ante rules on the relative monopoly rights of workers regarding their ex-post job security can indirectly affect outputs and welfare, because they overcome the time inconsistency problem and achieve a better alignment of incentives for workers to invest in human capital. The model also indicates that there can be interactions between financial deregulation and changes in relative worker monopoly rights and hence *de facto* job security. Particularly, a lowering of banks' monopoly rights can indirectly make worker layoff less likely, because more competitive banks have less bargaining power over worker layoff.

To test our theoretical predictions, we include the interaction term between the bank branch deregulation and employment protection indexes in our regression analysis. When we run the state-level regression like the employment-protection-only regression (1), there is no significant effect (report omitted).

Using state-industry level regressions, we are more likely to detect the channels through which financial deregulation and changes in employment protection affect output growth. Specifically, we use the two benchmark characteristics for each industry, intensity of knowledge use, as before, and dependence on external finance in addition. We interact these characteristics with the financial deregulation and employment protection indexes. We include state-industry fixed effects $\alpha_{s,j}$ to capture any state-specific industry growth trends, and state-year fixed effects $\alpha_{s,t}$ to control for other factors, such as state-specific business cycles and other policy changes. The use of these dummies also means we only need to include interaction terms because the simple effects from financial deregulation or employment protection are already absorbed in the state-year fixed effects. The full specification then becomes:

$$g_{j,s,t} = \alpha_{j,s} + \alpha_{s,t} + \beta WorkRight_{s,t-1} * KnowledgeDep_j + \gamma FinLib_{s,t-1} * ExtFinDep_j + \varepsilon_{j,s,t}. \quad (45)$$

where *ExtFinDep* denotes the industry's dependency on external finance and *KnowledgeDep* the industry's knowledge dependency as before. Again, we use the public policy based protection as the benchmark, though again regressions with the other employment protection measures show similar results (report omitted). We use only the nonfinancial sectors in the state-industry level regressions and we report robust *t*-statistics corrected for clustering at the state level.

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[29] Similar to knowledge intensity, we use Thomson Reuters data from 1991 to 2006. While the values of external finance dependency are not exactly the same as Rajan and Zingales (1998)—they use a different period and Compustat data, the industry ranking is virtually the same. Note that by 1991 the financial markets and labor reforms had been largely completed and the firm-level dependency on external financing and knowledge can be expected to be near their steady states (i.e., "natural" tendencies).

The effects of financial deregulation do not vary with industry's external financing when deregulation is the only regressor other than the fixed effects (Table 3, column 1). However, it becomes significant when the interaction term between workers' rights is also included as a regressor (Table 3, column 3). These results suggest that there are interactions between the two institutional changes that need to be controlled for in order to properly assess impacts.

The coefficient on the interaction term between the employment protection index and knowledge dependency is positive and statistically significant with or without controlling for financial deregulation (Table 3, columns 2 and 3). We thus find support for our prediction that increased employment protection adds to growth in value added through an industry-specific, knowledge intensity related channel. Although greater employment protection has little effect on overall economic activity, as suggested by the state-level regressions, it helps growth of those industries that are more knowledge dependent.[30]

Next we look at the relative strength of workers' monopoly rights, which we predict is indirectly strengthened by financial liberalization (i.e., fewer banks' monopoly rights), in particular for those industries that rely more on both external financing and workers' knowledge. To investigate this, we add a triple interaction term between the financial deregulation, employment protection, and industries' knowledge use indexes. We add as well the triple interaction term between the financial deregulation and employment protection indexes and the industries' external financing dependence. The regression specification then becomes:[31]

$$\begin{aligned} g_{j,s,t} = {} & \alpha_{j,s} + \alpha_{s,t} + \beta WorkRight_{s,t-1} * KnowledgeDep_j + \gamma FinLib_{s,t-1} * ExtFinDep_j \\ & + \delta_1 WorkRight_{s,t-1} * FinLib_{s,t-1} * KnowledgeDep_j \\ & + \delta_2 WorkRight_{s,t-1} * FinLib_{s,t-1} * ExtFinDep_j + \varepsilon_{j,s,t}. \end{aligned} \quad (46)$$

Table 3 (column 4) reports the regression results with these triple interaction terms. Both triple interaction terms are significantly positive (albeit only at the 10 percent significance level for the one with knowledge intensity), suggesting evidence of the importance of relative monopoly rights. As for the double interaction terms, there is little change compared to column 3 for the employment protection index interacted with knowledge dependency. However, the financial deregulation index interacted with external finance dependency becomes now insignificant. This suggests that the positive effects of financial deregulation for external finance dependent industries seems to arise primarily through the relative monopoly rights channel, supporting our model.

VI. Robustness Check

A. Alternative Knowledge Measures

As our first robustness test, we use two alternative sectoral measures for knowledge intensity. The first one is the sales-to-fixed-asset ratio, the reciprocal of conventional capital intensity, calculated at the industry level (Table 4, columns 1-3). The second is the industry-specific

[30] This also suggests greater employment protection adversely affects low knowledge intensive industries.
[31] When we include two additional interaction terms (i.e., *FinLib*KnowledgeDep* and *WorkRight*ExtFinDep*), we find that the coefficient estimates for other variables are more or less the same as in the regressions without these two terms and that the coefficient estimates for these two terms are often insignificant.

fraction of college graduates (Table 4, columns 4-6). Using either, regression results confirm that greater employment protection increases value added growth in knowledge-intensive industries, with results for the first alternative proxy similar or even somewhat stronger, and for the second somewhat weaker for the triple interaction terms.

B. Alternative Periods

Interstate branching was officially permitted across all states after 1994, which is why we used data only until 1993. However, some states are reported to have already allowed interstate banking, especially at the borders before 1993. We therefore also run the benchmark regression using data up to only 1990. This does not show any qualitative difference in the effects of financial deregulation and employment protection reforms on value added growth (regression results omitted).

C. Reverse Causality and Endogenous Policy Changes

Our results could be due to reverse causality, if differences in growth prospects in industries with varying external financing dependence or knowledge intensity drive changes in financial deregulation or employment protection. For example, firms may exercise more political pressure towards financial deregulation in states where they have more to gain. Or, lobbying for employment protection may be more intense in states where knowledge-based industries have more opportunities to prosper. If this were the case, our regression results would have an upward bias and the wrong interpretation may follow.

One simple, but very rough check for this is to conduct state-industry level regressions excluding some states. We already excluded the states Delaware and South Dakota as they had more liberalized financial systems for most of the period, maybe precisely because they had greater growth opportunities in financial services. We next also exclude the states of California and Massachusetts that arguably had the most knowledge-intensity industry growth over the sample period and therefore may have adopted greater employment protection. Also, we exclude the state of New York from our sample, as the financial industry seems exceptionally important for state growth. The regression results without these three states (report omitted) are, however, virtually the same as in Table 3.[32]

To control more generally for possible bias due to reverse causality and for various other types of economic and policy spillovers that may create endogeneity, we next employ the dynamic panel estimation technique of Blundell and Bond (1998) with autoregressive order one or two terms in the difference equations.[33] Note that, using the first difference model means we cannot include any more state-year and state-industry fixed effects and therefore

[32] Another potential source of bias may be spillovers. We have focused on within-state and time-series variations, including using standard errors clustered at the state-level. Doing so, however, we risk ignoring cross-state variations that can arise from growth and policy spillovers. Growth spillovers may arise if other (say, neighboring) states adopt policies which lead to higher growth in the state itself, even though it did not yet adopt any policy changes. Policy spillovers may arise due to political pressures or learning effects, states mimicking changes in neighboring or other states. However, both would lead to downward bias in our regressions, especially if people predicted future policy changes and started to change behavior in anticipation.

[33] Given the relatively large samples we have, we report two step estimation results with GMM standard errors, which take into account cross-state correlations.

need to reintroduce the financial deregulation and the changes in employment protection as stand-alone regressors.[34]

Table 5 shows that the key results broadly hold. When using the intangible-to-fixed-asset as the knowledge variable, the triple interaction term for knowledge dependence becomes insignificant but the triple interaction term for the external finance dependence remains significant (columns 2 and 3). When using the sales to fixed capital ratio, both triple interaction terms remain significant (columns 5 and 6). When using the college graduate share, the triple interaction term for external finance dependence becomes significant (columns 8 and 9), unlike the result in Table 3.[35]

D. Minimum Wage and Labor Union

Here, we examine whether minimum wage and labor union have effects similar to the exemption for wrongful discharges using the fixed effect estimation, similar to the benchmark regression. Note that any other state-level policy changes are already absorbed in the state-year fixed effects and state-industry trends in the state-industry fixed effects.

A high minimum wage is likely to reduce employment especially in low-skill industries (Partridge and Partridge, 1999). Minimum wages vary across US states and over time. The federal minimum wage is used as a state's effective minimum wage if the federal minimum wage is higher or if the state does not have a minimum wage. The federal minimum wage varies also over time. We obtain from the US Department of Labor each state's minimum wage for all years. We deflate the minimum wages by the national CPI and use the real values in the regressions.

The union coverage ratio (i.e., the portion of workforce that are covered by union collective bargaining) can be seen as another form of employment protection. However, unions in the US typically call for higher wages, but they are less effective in protecting employment (in part as firms may migrate to other states). Indeed, it is well documented that states with stronger unions have been losing jobs over time. In this sense, the union coverage ratio is expected to have aggregate effects through artificially raising wage level, rather than protecting employment.

We use state-level annual data on the union coverage from Hirsh and MacPherson (2003) from 1983 onwards. Note that union coverage also differs among industries but the state-industry level annual data is not available. In any case, such industry differences, with their slow movements over time, should be absorbed in the state-industry fixed effect in our regressions.

Figure 4 depicts the evolution of the averages of the state-specific minimum wages (solid line) and union coverage (dotted line). Both are on a declining trend, although the minimum wages show a zigzag pattern in the 1970s, in part as corrections for inflation, which was high

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[34] Following Blundell and Bond (1998), we also use the level equation as additional information in the GMM estimation. We include year dummies as exogenous instruments.

[35] The *m1* tests (for the first-order serial correlation) are met for all specifications while *m2* tests (for the second-order serial correlation) are not met at 5 percent level for AR(1) specifications when using the intangible-to-fixed-asset as the knowledge variable (columns 1 and 2) but the *m2* test for the AR(2) specification is fine (column 3) as well as for all other specifications. These results, however, need to be interpreted with caution as the Sargan tests generally reject as null that the over-identifying restrictions are valid (i.e., "goodness of fit" is low).

in that decade, might be imperfect. Correlations between these two variables and the exemption for wrongful discharges are reported in Table 1b. Union coverage is negatively correlated with the public policy based employment protection index, about -0.5. However, the minimum wage is slightly positively correlated with the employment protection index.

Given our theoretical model, notably Proposition 3, that minimum wages and union coverage—as they both raise wages directly or indirectly—are expected to have negative effects on job security and growth. Table 6 shows the regression results replacing the exemption for wrongful discharge as the *WorkRight* variable with either the minimum wage or the union coverage variable. The results are otherwise based on the benchmark specification, using the intangible-to-fixed-asset ratio as the industry knowledge proxy. Since the union coverage is available only from 1983, the regressions are conducted using data from 1983 to 1993. Columns 1 and 2 therefore first confirm the robustness of the benchmark regression results of Table 3 for this specific period, using the earliest of the exemption for wrongful discharge, with actually stronger interaction effects.

Altogether, the regression results confirm that artificially high wage, due to minimum wage or union, has negative effects on growth. Columns 3 and 4 show that union coverage negatively affects the growth of knowledge intensive industries, confirming the findings in the literature. However, no negative effect arises from the relative monopoly right channel with creditors, as none of the triple interactions terms are significant. Columns 5 and 6 show that the effects of the minimum wage are similar to those of union coverage, in that the minimum wage has detrimental effects on the growth of knowledge-intensive industries. As the minimum wage data is available from 1972 on, columns 7and 8 show that results hold using the longer data series. Note that, although one triple interaction term is significantly positive in this regression (Column 9), this term is not robustly significant for the period from 1983 to 1993 (Column 6).

E. Related Empirical Literature

In its empirical application, our paper also fits in the cross-country literature on the impacts of empirical protection and financial liberalization. In terms of labor markets, cross-country empirical studies for OECD (Organization of Economic Cooperation and development) countries (e.g., Scarpetta and Tressel, 2004, using industry level data; and Cingano, et al., 2010, using firm-level data) support the view of largely inefficient employment protection. And, Botero et al. (2004) shows that heavier labor regulation is associated with lower labor force participation and higher unemployment. Other cross-country evidence also generally finds negative effects of employment protection.

As for financial deregulation, empirical studies are mostly supportive, using cross-country and other evidence (e.g., Bekaert, Harvey, and Lundblad, 2005; and Townsend and Ueda, 2010). Also related is the empirical law and finance literature, again mainly cross-country in nature, which has focused on creditors' and minority shareholders' rights and largely considered these individual stakeholders' rights one by one. An extensive literature has investigated the effects of these rights using aggregate data or data on individual firms (La Porta, Lopez-de-Silanes, Shleifer and Vishny, 1997, 1998; Djankov, McLiesh, and Shleifer, 2007; De Nicolo, Laeven, and Ueda, 2008; Acharya, Amihud, and Litov, 2011; and Claessens, Ueda, and Yafeh, 2014). Studies generally document positive effects of stronger property rights, consistent with the value of securing claims, protecting (minority) investors against abuse by insiders (management or controlling shareholders), and overcoming

principal agent problems, but none considered or controlled for workers' rights at the same time.

While many studies cover the direct effects of employment protection and financial deregulation, only some theoretical models recognize the importance of analyzing jointly the roles and effects of various stakeholders' claims. Such scarce analyses (e.g., Allen, 2005; Allen, Carletti, and Marquez, 2007; and Tirole, 2006) argue that in a second-best world, with information asymmetries, agency issues, incomplete contracting, and other deviations from perfect factor markets, a proper configuration of various stakeholders' rights can lead to greater overall firm value maximization. Conversely, these theories suggest that firm performance varies with the legal rights and relative bargaining powers of multiple stakeholders. A particular implication of the incomplete-contract theory (e.g., Hart, 1995) is that workers with greater bargaining powers will have more incentives to invest in firm-specific skills.[36] Such positive effects may also show up at the economy-wide level (e.g., Caballero and Hammour, 1998; and Gervais, Livshits, and Meh, 2008). Again, however, a specific channel whereby bank regulation influences the balance of bargaining powers of stakeholders has not been articulated.

Only a few papers have investigated empirically how variations in multiple stakeholders' powers affect economic performance across countries or firms. Using country-level analysis, Fonseca and Utrero (2007) investigate the effects of labor regulation and barriers to entrepreneurship in the presence of credit-market frictions. They show that stricter employment protection laws and more barriers to entry negatively affect firms that are more dependent on external financing. Taking a cross-country perspective as well, but from a political economy point of view, Pagano and Volpin (2005) explain the observed negative correlation between shareholder protection and employment protection across OECD countries as the outcome of a combination of incumbent workers and inside owners/managers erecting barriers against minority shareholders.[37]

Besides changes in workers' and banks' monopoly rights, changes in shareholder protection can impact firm performance by affecting the availability of external financing and improving governance. Although well documented in cross-country studies, the effects of shareholder protection have been hard to detect within the US context. This is in part because most securities laws are federal and there is little state variation in equity rights.[38] Moreover, firms

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[36] Related corporate finance literature considers the joint effects of financial and labor conditions using firm-level data. Garmaise (2008), for example, finds that financially constrained small firms have greater difficulty in hiring new employees, and therefore provide greater de facto employment protection, thereby inducing more firm-specific investment. In contrast, Cronqvist, et al. (2009) find that entrenched CEOs pay more to employees to enjoy greater private benefits (e.g., less CEO efforts in wage bargaining and improved relations with employees).

[37] Some papers have analyzed the joint effects of creditor and labor rights using firm-level data. Atanassov and Kim (2009) investigate cross-country differences in firm-level restructuring and find that the firm's reaction to financial distress—asset sales or layoffs—depends on both the degree of investor protection and employment protection. The specific effect of stronger employment protection depends on the degree of investor protection, but in all cases, economic outcomes appear inefficient. Kim and Ouimet (2014), investigating the productivity effects of employee ownership plans, find some benefits for small firms, but not for firms with many employees due to free-riding. Moreover, such firm-level studies have difficulty in documenting economy- or industry-wide effects, such effects on extensive margin, i.e., increased levels of entrepreneurship and business closures, which have been found in other studies of US banking deregulation, e.g., by Kerr and Nanda (2009).

[38] Some papers find a decrease in market values for firms in jurisdictions that enact anti-takeover statutes (Karpoff and Malatesta, 1989, 1995; Szewczyk and Tsetsekos, 1992). Also, Bebchuk and Cohen (2003) find

subject to shareholder rules typically list on national stock exchanges, and are thus subject to the rules of the respective exchanges and not (just) state rules. Furthermore, such firms often establish their (pro-forma) headquarters in states with laws most conducive to shareholders' (or firms' management) interests. Together this makes firms' state headquarter location and local shareholders laws less relevant for analyses of state- or state-industry level value-added data. We therefore do not include shareholder rights in our empirical investigation.[39]

VII. CONCLUSION

We find empirically that basic labor rights can be beneficial to economic growth, in particular, for knowledge intensive industries, based on the natural experiments in the United States regarding institutional changes over the period 1972 to 1993. Our findings differ from existing empirical literature, which however mainly studied the effects of generous labor protection. A theory is thus needed to reconcile these two facts.

We develop a simple theory to shed light on the ex-post pie-splitting problem among firm managers (shareholders), creditors, and workers, when a firm runs into financial distress. The model requires financial friction, as otherwise the stochastic outputs can be insured perfectly. In essence, our theory endogenizes the severity of the hold-up problem among workers who invest in firm-specific human capital, creditors who try to get repaid as much as possible, and the firm manager who maximizes the shareholder value net of his own costs of verification and negotiation. The model extends the costly state verification theory (Townsend, 1979) to show that not only a debt-type bank loan contract but also a fixed wage contract with possible layoff are chosen as rational choice. Moreover, the decision by the firm manager in distress can be considered as a variant of the debt overhang problem and not socially optimal in general.

The new theory shows an inverted-U shaped relation between labor protection and growth: While too rigid labor protection is detrimental to growth, basic labor standard can boost the output of industries requiring firm-specific human capital. Moreover, what is important is the relative strength of workers' monopoly rights, which banks' monopoly rights affect negatively. This interaction between labor and bank monopoly rights is also a new insight, as existing theories on monopolistic banks mostly focus on the ex-ante decision of lending and do not imply anything about the indirect effect.

We then test our model predictions on the interaction between banks' and workers' monopoly rights. We find consistent evidence that the growth enhancing effect of basic labor standard is stronger when bank branch deregulation also takes place.

This is not to say that more rigid labor protections are always good for economic growth. Indeed, as we find theoretically and have indicated empirically, the relationship between employment protection and economic growth is inverted-U shaped. That is, generous labor protection brings about inefficiencies, as often shown in the existing empirical literature, in particular for continental Europe and Japan. But, we show theoretically that basic

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that states that offer stronger anti-takeover protections are substantially more successful in both retaining in-state firms and attracting out-of-state corporations. But, again, these papers do not study the overall economic impact or take into account the bargaining powers of other stakeholders.

[39] Data for state-level shareholder protection is also only available from 1986 on. In a working paper version, we analyzed a shareholder protection measure based on Bebchuk and Cohen (2003) but did not find significant effects.

employment protection can boost productivity by inducing firm specific human-capital investments and empirically find supportive evidence in US historical data.

We would also like to highlight that labor and financial institutional changes interact each other as the balance of these two affects the corporate decision on worker layoffs and loan repayments. This contrasts to past research, which has usually studied the effects of labor protection and financial liberalization separately from each other. Apparently, future research would be wise to consider the joint effects on economic growth and other related issues, such as productivity and capital flows.

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Appendix

I. CONDITION THAT MAKES ASSUMPTION 6 VALID

Lemma A1.
The condition for no externality in investing human capital, $B'(h)=0$, *is achieved when either* $\lambda=1$ *or, for* $\lambda<1$,

$$\frac{\alpha\hat{y}^{*}-wh\hat{l}}{E[\hat{y}]}=\frac{\int_{\underline{\rho}}^{\rho^{*}}l^{*}f(\rho)d\rho}{(\hat{l}-l^{**})f(\rho^{*})}, \tag{A1}$$

*where l** is l* evaluated at* ρ^{*}, *and* $\hat{y}^{*}$ *is output with full employment at the threshold signal* ρ^{*}.

Note that the left-hand side of (A1) is the extra pay to capital holders at the default threshold as a ratio to the expected output with full employment. As for the right-hand side, the numerator is the expected employment conditional on signals less than the default threshold, and the denominator is the number of fired workers, again at the default threshold.

Proof.
For $\lambda<1$, given wage and risk-free rate, the default threshold is lower for higher effective labor,

$$\frac{\partial\rho^{*}}{\partial(hl)}=\frac{wh\hat{l}-\alpha\hat{y}^{*}}{k^{1-\alpha}(h\hat{l})^{\alpha+1}}<0. \tag{A2}$$

This is because

$$\frac{\partial\rho^{*}}{\partial(hl)}=\frac{w}{k^{1-\alpha}(h\hat{l})^{\alpha}}-\alpha\frac{rk+wh\hat{l}}{k^{1-\alpha}(h\hat{l})^{\alpha+1}}=\frac{wh\hat{l}-\alpha(rk+wh\hat{l})}{k^{1-\alpha}(h\hat{l})^{\alpha+1}}. \tag{A3}$$

And, at the default threshold, $rk+wh\hat{l}$ is equal to the whole output $\hat{y}^{*}$ implied by (3). Then, by (6), (A2) is true.

(A2) immediately implies that either higher human capital or higher labor input lowers the default threshold,

$$\frac{\partial\rho^{*}}{\partial h}<0 \text{ and } \frac{\partial\rho^{*}}{\partial l}<0. \tag{A4}$$

The derivative of *B(h)* can be written as

$$B'(h)=-f(\rho^{*})\frac{\partial\rho^{*}}{\partial h}+e^{*}f(\rho^{*})\frac{\partial\rho^{*}}{\partial h}+\int_{\underline{\rho}}^{\rho^{*}}\frac{\partial e}{\partial h}f(\rho)d\rho, \tag{A5}$$

where *e** is evaluated at ρ^{*}, and (A5) can be expressed as

$$
\begin{aligned}
&= (e^* - 1) f(\rho^*) \frac{\partial \rho^*}{\partial h} + \int_{\underline{\rho}}^{\rho^*} -\frac{1-\lambda}{\hat{l}} \frac{k}{h^2} \left(\frac{\alpha \rho}{w} \right)^{\frac{1}{1-\alpha}} f(\rho) d\rho \\
&= \frac{\left((1-\lambda) l^{**} + \lambda \hat{l} \right) - \hat{l}}{\hat{l}} f(\rho^*) \frac{wh\hat{l} - \alpha \hat{y}^*}{k^{1-\alpha} (h\hat{l})^{\alpha+1}} \hat{l} - \int_{\underline{\rho}}^{\rho^*} \frac{1-\lambda}{h} \frac{l^*}{\hat{l}} f(\rho) d\rho \\
&= \frac{1-\lambda}{h\hat{l}} \left((l^{**} - \hat{l}) \frac{wh\hat{l} - \alpha \hat{y}^*}{k^{1-\alpha} (h\hat{l})^{\alpha}} f(\rho^*) - \int_{\underline{\rho}}^{\rho^*} l^* f(\rho) d\rho \right) \\
&= \frac{1-\lambda}{h\hat{l}} \left((\hat{l} - l^{**}) \frac{\alpha \hat{y}^* - wh\hat{l}}{E[\hat{y}]} f(\rho^*) - \int_{\underline{\rho}}^{\rho^*} l^* f(\rho) d\rho \right).
\end{aligned}
\tag{A6}
$$

In the last line, note that $E[\theta]=E[\rho]=1$ by assumption.

If $\lambda=1$, the last line in (A6) is zero. Otherwise, the first term in the parentheses is positive by (A2) but the second term is apparently negative. Therefore, in general, $B'(h)$ can be positive or negative depending on the relative value of the first term against the second term in the final line in (A6). However, (A1) is the necessary and sufficient condition to make the parentheses term zero and then $B'(h)=0$.

Q.E.D.

II. PROOF FOR PROPOSITION 2

Assuming no one can commit to a future plan, the constrained socially optimal choice of human capital investment by (16) coincides with the decentralized decision by (13) when the extensive margin change $B'(h) = 0$ is at the decentralized optimal decision $h=h^*$. And, because u' is decreasing ($u''<0$) and v' is increasing ($v''>0$), without external effect through $B(h)$, condition (13) (and (16)) must have a unique solution for h.

III. PROOF FOR COROLLARY 2

We investigate the first order condition (13) to determine human capital investment. For higher capital k, l^* (and l_λ inside e) is apparently higher. Then, the right-hand side of (13) becomes higher. On the other hand, higher $\hat{l}$ (near full employment) reduces employment rate e and optimal human capital investment h^*.[40]

As for the relative monopoly rights of workers λ, the proof is a bit complex. Let χ denote the right-hand side minus the left-hand side of (13), the first order condition regarding the human capital investment. Then,

$$
\frac{dh^*}{d\lambda} = -\left. \frac{\partial \chi / \partial \lambda}{\partial \chi / \partial h} \right|_{h=h^*}. \tag{A7}
$$

The denominator is negative,

---

[40] $\frac{\partial e}{\partial \hat{l}} = \frac{1}{\hat{l}^2} \left(\lambda(1-\hat{l}) - (1-\lambda) l^* \right) < 0$ in equilibrium near full employment, i.e., $\hat{l} = 1$.

$$\frac{\partial \chi}{\partial h} = B'(h)u'(wh)w + B(h)u''(wh)w^2 - v''(h) < 0. \tag{A8}$$

The first term is zero under Assumption 6 (i.e., *B'(h)=0*). The second term is negative by assumption of concave utility of consumption. The third term is also negative by assumption of convex disutility of human capital investment, *v*.

The numerator is

$$\frac{\partial \chi}{\partial \lambda} = \frac{\partial B(h)}{\partial \lambda} u'(wh)w. \tag{A9}$$

And, noting that partial derivative of ρ^* with respect to λ is zero as there is no direct relation,

$$\frac{\partial B(h)}{\partial \lambda} = \int_{\underline{\rho}}^{\rho^*} \frac{\partial e}{\partial \lambda} f(\rho) d\rho > 0, \tag{A10}$$

where

$$\frac{\partial e}{\partial \lambda} = \frac{\hat{l} - l^*}{\hat{l}} > 0. \tag{A11}$$

Overall, in equilibrium, (A7) is positive

$$\frac{dh^*}{d\lambda} > 0. \tag{A12}$$

IV. PROOF FOR PROPOSITION 3

Given $\bar{h}$, the derivative of right-hand side of the first order condition (13) with respect to wage *w* is given by

$$\frac{\partial B(\bar{h})}{\partial w} u'(wh)w + B(\bar{h}) \frac{\partial u'(wh)w}{\partial w} \tag{A13}$$

If this is negative, human capital investment *h* is decreasing with wage *w* because the left-hand side of (13), *v'(h)>0*, is increasing in *h*, i.e., *v''(h)>0*. Assumption 7 implies that the second term of (A13) is negative,

$$\frac{\partial}{\partial w} u'(wh)w = u'(wh) + u''(wh)wh \le 0. \tag{A14}$$

As for the first term of (A13),

$$\frac{\partial B(\bar{h})}{\partial w} = (e^* - 1) f(\rho^*) \frac{\partial \rho^*}{\partial w} + e^* f(\rho^*) \frac{\partial e^*}{\partial w} + \int_{\underline{\rho}}^{\rho^*} \frac{\partial e}{\partial w} f(\rho) d\rho, \tag{A15}$$

where

$$\frac{\partial e}{\partial w}=\frac{1-\lambda}{\hat{l}}\frac{\partial l^*}{\partial w}=\frac{(1-\lambda)}{\hat{l}}\frac{l^*}{(1-\alpha)w} \tag{A16}$$

and

$$\frac{\partial \rho^*}{\partial w}=\frac{h\hat{l}}{E[\hat{y}]}. \tag{A17}$$

Here, also consider *B'(h)*, which is zero by Assumption 6,

$$\frac{\partial B(h)}{\partial h}=(e^*-1)f(\rho^*)\frac{\partial \rho^*}{\partial h}+e^*f(\rho^*)\frac{\partial e^*}{\partial h}+\int_{\underline{\rho}}^{\rho^*}\frac{\partial e}{\partial h}f(\rho)d\rho, \tag{A18}$$

where

$$\frac{\partial e}{\partial h}=-\frac{(1-\lambda)l^*}{h\hat{l}} \tag{A19}$$

and

$$\frac{\partial \rho^*}{\partial h}=\frac{w\hat{l}}{k^{1-\alpha}(h\hat{l})^{\alpha}}-\alpha\hat{l}\frac{rk+wh\hat{l}}{k^{1-\alpha}(h\hat{l})^{\alpha+1}}=\frac{wh\hat{l}-\alpha\hat{y}^*}{E[\hat{y}]h}. \tag{A20}$$

Comparing (A15) – (A17) and (A18) – (A20),

$$\frac{\partial B(\bar{h})}{\partial w}=-B'(\bar{h})\frac{\bar{h}}{w(1-\alpha)}+\frac{(e^*-1)}{E[\hat{y}]}f(\rho^*)\left\{\frac{wh\hat{l}-\alpha\hat{y}^*}{w(1-\alpha)}+h\hat{l}\right\}<0. \tag{A21}$$

While the first term of (A21) is zero by Assumption 6, the sign of the second term depends on (the opposite of) the sign of the parentheses term. Although $wh\hat{l}<\alpha\hat{y}^*$ as shown in (6), the difference becomes small for small τ. Then, for small τ, which we assume here, the parentheses term is positive. Overall, (A21) becomes negative and so does (A13).

V. PROOF FOR PROPOSITION 4

By assumption, labor is inelastically supplied at one. The equation (20) provides the labor demand function. Let *J* denote the left-hand side of (20). Then, the labor demand curve is decreasing as usual,

$$\frac{dw}{d\hat{l}}=-\frac{\partial J/\partial \hat{l}}{\partial J/\partial w}<0, \tag{A22}$$

because it is easy to see $\partial J/\partial w<0$ and $\partial J/\partial \hat{l}<0$. Apparently, the demand and the supply functions cross once (ignoring the external margin (22) for small τ).

VI. PROOF FOR PROPOSITION 5

Because firm's capital demand is constrained by the bank participation condition (18), the relation between *r* and *k* dictated by (18) constitutes the capital demand function by firms. Let *G* denote the right-hand side minus the left-hand side of (18). Given ρ^*,

$$\frac{dr}{dk} = -\frac{\partial G / \partial k}{\partial G / \partial r} < 0, \tag{A23}$$

where

$$\frac{\partial G}{\partial r} = \int_{\rho^*}^{\bar{\rho}} kf(\rho)d\rho - k + \left(\rho^* k^{1-\alpha}(h^* l_\lambda)^\alpha - wh^* l_\lambda - rk\right) f(\rho^*) \frac{k}{k^{1-\alpha}(h\hat{l})^\alpha} < 0 \tag{A24}$$

and

$$\begin{aligned} \frac{\partial G}{\partial k} &= \int_{\rho^*}^{\bar{\rho}} rf(\rho)d\rho + \int_{\rho}^{\rho^*} (1-\alpha)k^{-\alpha}(h^* l_\lambda)^\alpha f(\rho)d\rho - r_F \\ &\quad + \left(\rho^* k^{1-\alpha}(h^* l_\lambda)^\alpha - wh^* l_\lambda - rk\right) f(\rho^*) \left(\frac{rk - (1-\alpha)\hat{y}^*}{kE[\hat{y}]}\right) \\ &< 0. \end{aligned} \tag{A25}$$

Then, (A23) means that the capital demand by firms is negatively sloping. On the other hand, the capital supply is fixed at *k* assuming all capital is used domestically as the arbitrage condition (18) is satisfied. Therefore, the equilibrium interest *r* is determined, given ρ^*. Here, bank participation constraint (18) implies that, given risk free rate r_F, lower threshold ρ^* allows higher probability of full loan repayment with promised rate *r*. This means, for the same *r*, lower threshold ρ^* pushes up the demand for capital *k*. Hence, with the fixed initial *k*, *r* and ρ^* are negatively related. However, the default threshold condition (1) implies the opposite: *r* and ρ^* are positively related (i.e., lower promised interest rate *r* allows lower threshold level ρ^* to repay in full). Therefore, at the cross-point of two relations, the financial contract represented by (*r*, ρ^*) is uniquely determined given *k*, together with the equilibrium wage and labor.

VII. PROOF FOR PROPOSITION 6

The worker power λ^* is defined to maximize firm value (19). Note that some variables are endogenous in the equilibrium but we can solve the firm maximization problem with respect to worker power λ, given wage *w* and risk-free rate r_F for this proposition (because we focus on a local solution). The first order condition to maximize the firm profits (18) with respect to the worker power λ, given wage and risk-free rate, is

$$\begin{aligned} 0 &= -\left(\rho^* k^{1-\alpha}(h^* \hat{l})^\alpha - wh^* \hat{l}\right) \frac{\partial \rho^*}{\partial \lambda} \\ &\quad + \left(\rho^* k^{1-\alpha}(h^* l_\lambda)^\alpha - wh^* l_\lambda - \tau\right) \frac{\partial \rho^*}{\partial \lambda} \\ &\quad + \int_{\rho^*}^{\rho} \left(\alpha\rho k^{1-\alpha}(h^* \hat{l})^{\alpha-1}\hat{l} - w\hat{l}\right) \frac{\partial h^*}{\partial \lambda} f(\rho)d\rho \\ &\quad + \int_{\rho^*}^{\bar{\rho}} \left(\alpha\rho k^{1-\alpha}(h^* l_\lambda)^{\alpha-1} l_\lambda - wl_\lambda\right) \frac{\partial h^*}{\partial \lambda} f(\rho)d\rho. \end{aligned} \tag{A26}$$

Here, the first and second terms cancel out each other. The first term is the output with initial labor inputs minus the wage payments at the default threshold. By (1), this is equal to the repayments to banks, *rk*, without any extra profits to shareholders. The second term is the output with restructured labor inputs minus the wage payments (and the verification and

negotiation costs) at the default threshold. By construction, this is equal to the repayments to banks, *rk.* By arbitrage, these two repayments to banks must be equal at the default threshold.

Therefore, the first order condition with respect to λ consists of the remaining two terms only,

$$0 = \hat{l}\frac{\partial h^*}{\partial \lambda}\int_{\rho^*}^{\bar{\rho}}\left(MPL_1 - w\right)f(\rho)d\rho + \frac{\partial h^*}{\partial \lambda}\int_{\underline{\rho}}^{\rho^*}\left(MPL_2 - w\right)l_\lambda f(\rho)d\rho. \tag{A27}$$

We use (20), the first order condition to determine the initial workforce $\hat{l}$, as the equilibrium relationship between *MPL1* and *MPL2*. Then, (A27) becomes

$$0 = \frac{\partial h^*}{\partial \lambda}\int_{\underline{\rho}}^{\rho^*}\left(MPL_2 - w\right)\left(l_\lambda - \frac{\Psi_2}{\Psi_1}\hat{l}\right)f(\rho)d\rho. \tag{A28}$$

As already discussed, *MPL2* is always equal to *w* for any realization of ρ in case $\lambda = 0$. In case of $\lambda \to 1$, as shown in (23), $l_\lambda \to \hat{l}$ (i.e., $\psi_2 \to \psi_1$ and $MPL_2 \to MPL_1$), and the expected *MPL1* becomes equal to *w*. Therefore, (A28) is equal to zero in these two cases.

Moreover,

$$\begin{aligned} l_\lambda - \frac{\Psi_2}{\Psi_1}\hat{l} &= (1-\lambda)l^* + \lambda\hat{l} - \lambda\hat{l} - (1-\lambda)\frac{\frac{\partial h^*}{\partial \hat{l}}l^*\hat{l}}{\frac{h^*}{\hat{l}} + \frac{\partial h^*}{\partial \hat{l}}} \\ &= (1-\lambda)\left(\frac{\frac{h^*}{\hat{l}} + \frac{\partial h^*}{\partial \hat{l}}(1-\hat{l})}{\frac{h^*}{\hat{l}} + \frac{\partial h^*}{\partial \hat{l}}}\right)l^* \\ &= (1-\lambda)\left(\frac{1 + \frac{\partial \log h^*}{\partial \log \hat{l}}(1-\hat{l})}{1 + \frac{\partial \log h^*}{\partial \log \hat{l}}}\right)l^*. \end{aligned} \tag{A29}$$

Here,

$$\frac{\partial \log h^*}{\partial \log \hat{l}} = -\frac{\partial \chi / \partial \hat{l}}{\partial \chi / \partial h}\frac{\hat{l}}{h}\bigg|_{h=h^*}. \tag{A30}$$

The denominator is negative as given already by (A8). As for the numerator,

$$\frac{\partial \chi}{\partial \hat{l}} = \frac{\partial B(h)}{\partial \hat{l}}u'(wh)w. \tag{A31}$$

And,

$$\frac{\partial B(h)}{\partial \hat{l}} = (e^* - 1)f(\rho^*)\frac{\partial \rho^*}{\partial \hat{l}} + e^* f(\rho^*)\frac{\partial e^*}{\partial \hat{l}} + \int_{\underline{\rho}}^{\rho^*}\frac{\partial e}{\partial \hat{l}}f(\rho)d\rho, \tag{A32}$$

where

$$\frac{\partial e}{\partial \hat{l}} = -(1-\lambda)\frac{l^*}{\hat{l}^2} \tag{A33}$$

and

$$\frac{\partial \rho^*}{\partial \hat{l}} = \frac{wh}{k^{1-\alpha}(h\hat{l})^{\alpha}} - \alpha h \frac{rk + wh\hat{l}}{k^{1-\alpha}(h\hat{l})^{\alpha+1}} = \frac{wh\hat{l} - \alpha\hat{y}^*}{E[\hat{y}]\hat{l}}. \tag{A34}$$

Note that $E[\rho]=1$ (assumption) is used in the final form of the denominator above and, for the numerator, the sum of the capital rent payments and wage payments equals the output at the default threshold, y*.

Comparing (A15)-(A17) and (A32)-(A34) with Assumption 6, we have

$$\frac{\partial B(h)}{\partial \hat{l}} = \frac{\partial B(h)}{\partial h}\frac{h}{\hat{l}} = 0. \tag{A35}$$

This implies

$$\frac{\partial \log h^*}{\partial \log \hat{l}} = 0 \tag{A36}$$

in (A29) and therefore the first order condition of firm profits with respect to worker power λ, (A28), becomes

$$0 = \frac{\partial h^*}{\partial \lambda}(1-\lambda)\int_{\underline{\rho}}^{\rho^*}\left(MPL_2 - w\right)l^* f(\rho)d\rho. \tag{A37}$$

Again, this shows two corner solutions $\lambda=1$ and $\lambda=0$ ($MPL_2=w$ for any ρ if $\lambda=0$) to satisfy the condition (to be local minima) and the possibility of an internal solution λ^* that satisfies

$$0 = \int_{\underline{\rho}}^{\rho^*}\left(MPL_2 - w\right)l^* f(\rho)d\rho. \tag{A38}$$

This condition is (25), and can be indeed satisfied—note that this MPL_2 is with l_λ and thus not necessary for the case with profit-maximizing l^* with which always $MPL_2 = w$.

To see that (A38) can be satisfied, note that the equilibrium wage w_0 with $\lambda=0$ is different from the equilibrium wage w_λ with $\lambda>0$. Also note that equilibrium human capital investment h_0^* with =0 and h_λ^* with >0 are different. Because $\partial h^*/\partial\lambda > 0$ by Corollary 2 and $l_\lambda > l^*$ by construction, MPL_2 with $\lambda>0$ is lower than MPL_2 with $\lambda=0$, i.e., for any realization of ρ,

$$\alpha\rho k^{1-\alpha}(h_\lambda^* l_\lambda)^{\alpha-1} < \alpha\rho k^{1-\alpha}(h_0^* l^*)^{\alpha-1}. \tag{A39}$$

This implies that, for (A38) to be satisfied, the equilibrium wage w_λ with $\lambda>0$ must be lower than
the equilibrium wage w_0 with $\lambda=0$. Indeed, if the wage level is the same at w_0, then the right-hand side of (A38) is negative,

$$\int_{\underline{\rho}}^{\rho^*}\left(\alpha\rho k^{1-\alpha}(h_\lambda^* l_\lambda)^{\alpha-1}-w_0\right)l^* f(\rho)d\rho<\int_{\underline{\rho}}^{\rho^*}\left(\alpha\rho k^{1-\alpha}(h_0^* l^*)^{\alpha-1}-w_0\right)l^* f(\rho)d\rho=0. \quad \text{(A40)}$$

Note that the right side is just $MPL_2=w$ for any ρ when $\lambda=0$. Therefore,

$$w_\lambda < w_0 \quad \text{(A41)}$$

is necessary to satisfy (A38).

Of course, w_λ cannot be chosen freely. Given certain wage w, λ is chosen here to maximize profits, but then that w must also satisfy the equilibrium condition (20). Moreover, (A38) or (25) implies that the second term of equilibrium condition (20) is zero, and hence a stricter condition (24) needs to be satisfied. But, this can be done, because the left-hand side of (24) is MPL_1, which is lower with higher human capital $h_\lambda^* > h_0^*$ and the right-hand side of (24) is wage, which is also lower $w_\lambda < w_0$. Also, equilibrium interest rate r_λ adjusts. A caveat is that internal equilibrium combination $(r_\lambda, w_\lambda, \lambda^*)$ may not always exist or can be multiple, if it exists.

Next, we claim that this internal solution λ^* is indeed a maximand by looking at the second order condition. Let L denote the right-hand side of the first order condition (A37).

$$\begin{aligned}\left.\frac{\partial L}{\partial\lambda}\right|_{w=w_\lambda} &= \frac{\partial^2 h^*}{\partial\lambda\partial\lambda}(1-\lambda)\int_{\underline{\rho}}^{\rho^*}\left(MPL_2-w_\lambda\right)l^* f(\rho)d\rho \\ &\quad -\frac{\partial h^*}{\partial\lambda}\int_{\underline{\rho}}^{\rho^*}\left(MPL_2-w_\lambda\right)l^* f(\rho)d\rho \\ &\quad +\frac{\partial h^*}{\partial\lambda}(1-\lambda)\int_{\underline{\rho}}^{\rho^*}\frac{\partial MPL_2}{\partial\lambda}l^* f(\rho)d\rho.\end{aligned} \quad \text{(A42)}$$

Here, the first and second lines are both equal to zero for $\lambda=\lambda^*$ because of (A38). Since it is easy to show $\partial MPL_2/\partial\lambda<0$, the overall (A42) is negative. This means that, at least locally around λ^*, there is an inverted-U shaped relationship between worker right λ and firm profits (Figure 1).

VIII. PROOF FOR COROLLARY 6

In discussions below (A28) and (A37), we have already shown that $\lambda=0$ and 1 are both equilibria as corner solutions.

Moreover, even for internal solutions, it is difficult to establish uniqueness, as explained in the proof for Proposition 6. Proposition 6 says, given r and w are determined by Propositions 4 and 5, there may exist λ, the internal solution to maximize the firm profits. However, Propositions 4 and 5 determine r and w uniquely under specific λ. This means that, under different λ, there can be different equilibrium values for r and w. Hence, the equilibrium triplet $(r_\lambda, w_\lambda, \lambda^*)$ is not uniquely determined.

Again, note that (25) is a key restriction for λ^* to be an equilibrium for firms with commitment. Among triplets (r, w, λ) that satisfy Assumptions 1 to 7 (and hence Propositions 4 and 5), not all meet the condition (25) that is required for worker power λ to be an optimal λ^*.

Lastly, note that the similar logic to show $w_\lambda < w_0$ in the above proof for Proposition 6 goes through for any higher worker rights. That is, the equilibrium wage w_λ is lower for higher worker rights λ.

IX. Proof for Proposition 7

From the production side, the social planner faces his first order condition, which is the first order condition of the private firm (A37) minus the net social loss, which is the sum of (26) and (27). Here, although $\lambda = 0$ and 1 can make (A37) equal to zero, they cannot do so for the sum of (26) and (27). When $\lambda = 1$, (26) is zero as no one is fired but (27) is positive. When $\lambda = 0$, (27) is likely zero since it is likely there is no suboptimal retention of workers, implying $\hat{\rho} = \underline{\rho}$, but (26) is positive.

In general, there can be an internal solution λ^{SP} that solves the social planner's problem. Apparently, the privately optimal λ^* can be the same as socially optimal λ^{SP}, when the sum of (26) and (27) is zero. That is, when the negative and positive externalities of firing coincide.

Figure 1. Adoption of Employment Protection
(Number of states with employment protection)

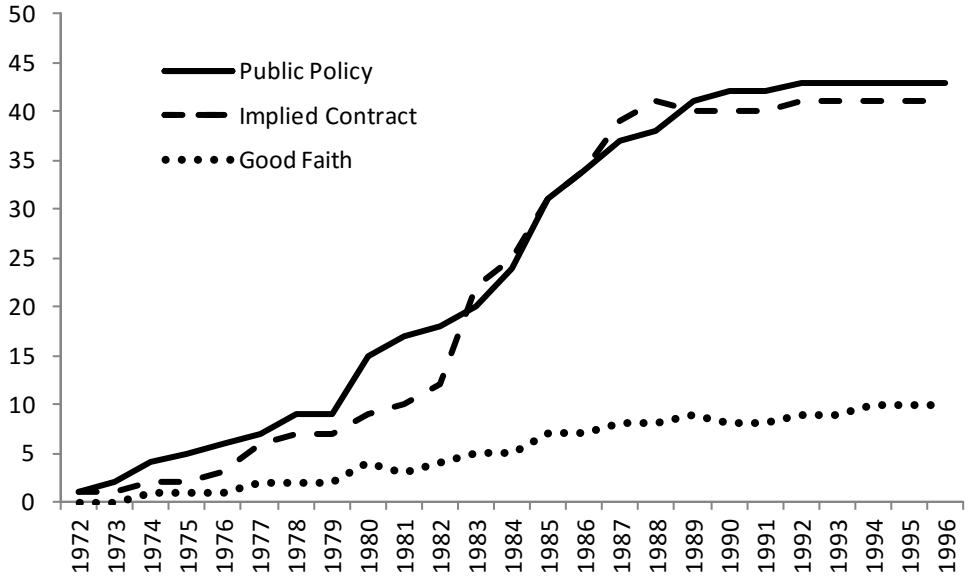


Figure 2. Inverted-U Shape of Effects of Relative Bargaining Power on Firm Profit (*λ-profit plane*)

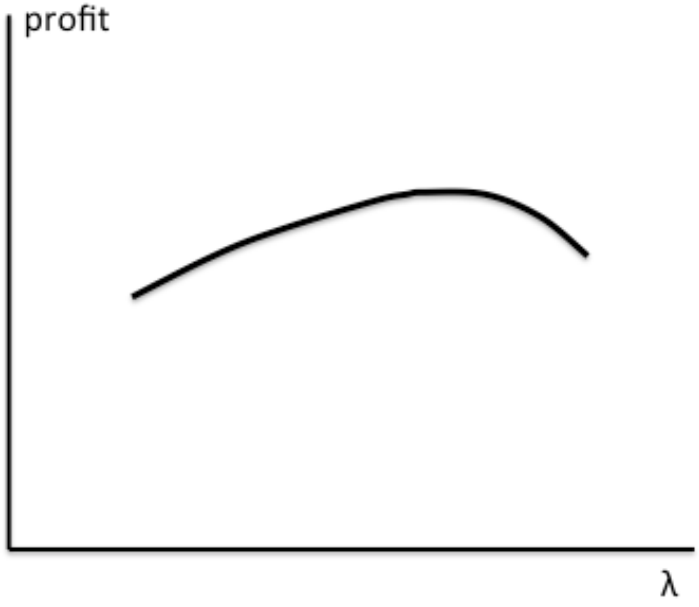


Figure 3. Adoption of Financial Deregulation
(Number of states deregulating)

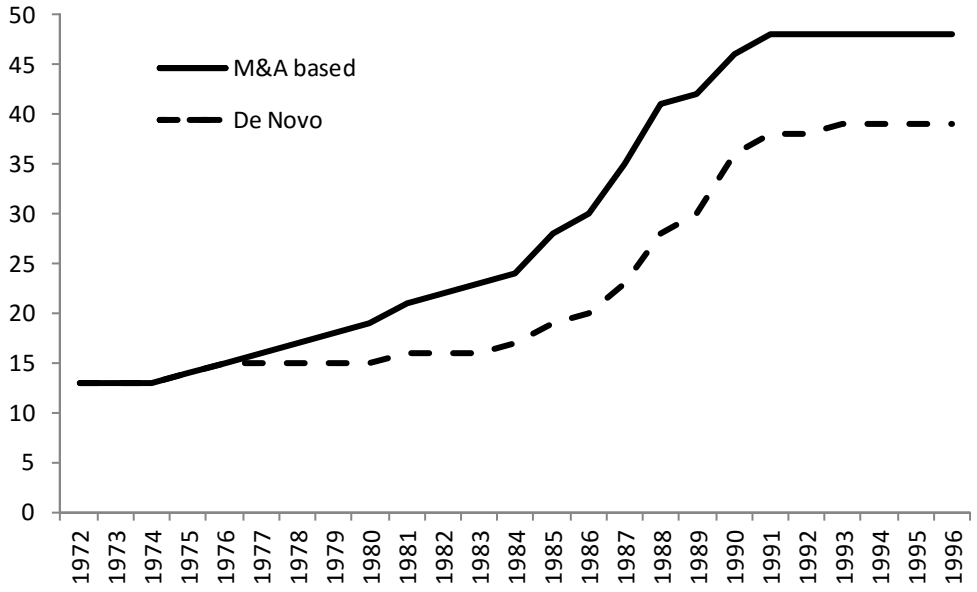
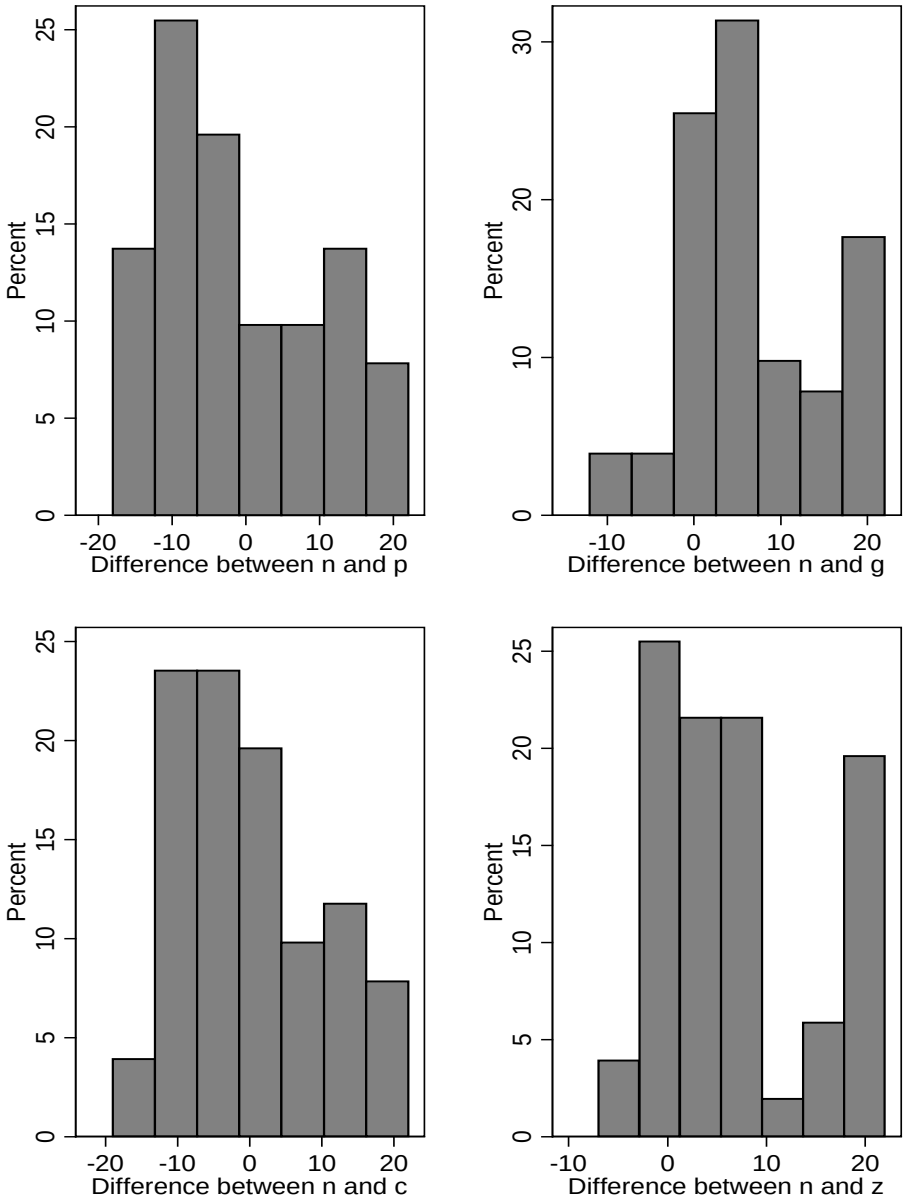
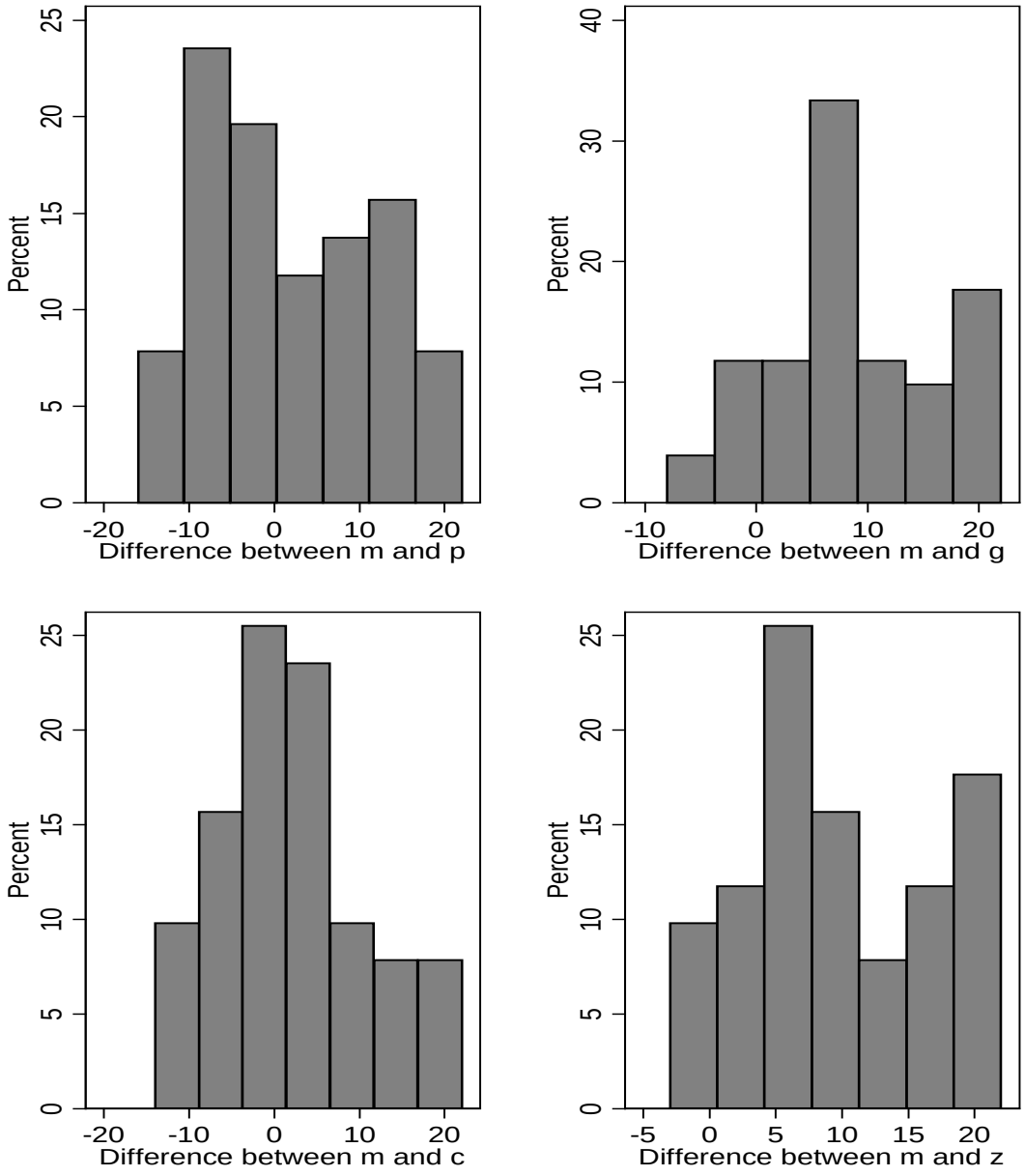


Figure 3a: Pattern of Adoption of Employment Protection and Financial Deregulation



Notes:
n is the dummy indicating the year branch restrictions were lifted via de novo branching
p is the public policy index
g is the good faith index
c is the implied contract index
z is the earliest of p, g and c

Figure 3b: Pattern of Adoption of Employment Protection and Financial Deregulation



Notes:
m is the dummy indicating the year M&A branch restrictions were lifted
p is the public policy index
g is the good faith index
c is the implied contract index
z is the earliest of p, g and c

Figure 4: US-wide Average of Other State-Specific Labor Protections

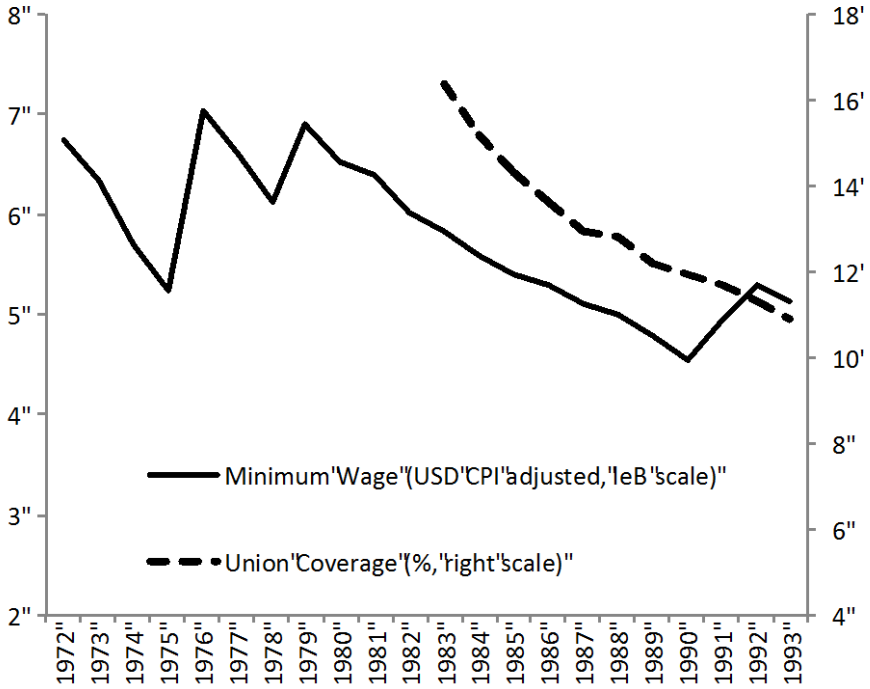


Table 1a. Key Descriptive Statistics of Variables

	Observation	Mean	Std. Dev.	Min	Max
State-Year Institutional Changes					
Employment Protection					
(Exception for Wrongful Discharges)					
Public Policy	990	0.45	0.50	0.00	1.00
Good Faith	990	0.07	0.26	0.00	1.00
Contract	990	0.41	0.49	0.00	1.00
Earliest	990	0.54	0.50	0.00	1.00
Other Labor Protection					
Union Coverage Rate (%)	1012	5.75	0.78	4.41	9.27
Minimum Wage Level, Real	506	13.02	5.46	3.70	28.00
Financial Deregulation (Bank Branch Deregulation)					
M&A	1012	0.49	0.50	0.00	1.00
de novo	1012	0.37	0.48	0.00	1.00
Industry Characteristics					
Knowledge Dependency					
Intangible / Fixed Assets Rate	59	6.00	5.70	0.33	27.84
Sales / Fixed Assets Ratio	59	0.62	0.60	0.00	2.87
Schooling (Fraction of College Grad in2005)	49	0.44	0.18	0.19	0.83
External Finance Dependence	59	-0.49	2.01	-12.24	3.19
Real Value Added Growth					
State-Year Growth Rate	1012	2.48	4.88	-34.92	35.44
State-Inudstry-Year Growth Rate	54706	2.43	19.67	-310.23	380.76
(after taking out 3 standard-deviation outliers)	*46945*	*1.77*	*13.07*	*-53.57*	*53.51*

Note: Court-ruled employment protection variables are not available for DC. Union data is available only from 1983.
For state-industry level regressions, growth rates are used after removing 3 standard-deviation outliers.

Table 1b. Correlations among State-Year Level Institutional Changes

	Employment Protection				Other Labor Protection		Financial Deregulation	
	Public Policy	Good Faith	Contract	Earliest	Union Coverage	Minimum Wage	M&A	de novo
Public Policy	1.000 *990*							
Good Faith	0.250 *990*	1.000 *990*						
Contract	0.539 *990*	0.124 *990*	1.000 *990*					
Earliest	0.830 *990*	0.254 *990*	0.763 *990*	1.000 *990*				
Union Coverage	-0.513 *990*	-0.131 *990*	-0.524 *990*	-0.526 *990*	1.000 1012			
Minimum Wage	0.146 *495*	-0.039 *495*	0.145 *495*	0.233 *495*	0.238 *506*	1.000 *506*		
M&A	0.242 *990*	0.144 *990*	0.294 *990*	0.256 *990*	-0.315 *1012*	-0.162 *506*	1.000 *1012*	
de novo	0.140 *990*	0.111 *990*	0.187 *990*	0.138 *990*	-0.159 *1012*	-0.174 *506*	0.768 *1012*	1.000 *1012*

Note: Italics numbers show the observation numbers. Court-ruled employment protection variables are not available for DC. Union data is available only from 1983.

Table 1c. Correlations among Industry-Level Characteristics

	Intangible Assets / Fixed Assets	Sales / Fixed Assets Ratio	Schooling (Fraction of College Grad)	External Finance Dependence
Intangible / Fixed Assets Ratio	1.000 *59*			
Sales / Fixed Assets Ratio	0.708 *59*	1.000 *59*		
Schooling (Fraction of College Grad in 2005)	0.382 *49*	0.544 *49*	1.000 *49*	
External Finance Dependence	-0.524 *59*	-0.436 *59*	-0.120 *49*	1.000 *59*

Note: Italics numbers show the observation numbers.

Table 2. Regressions of Employment Protection on Growth

The dependent variable is the real growth rate of gross state product for column 1, and gross state-indusry product for columns 2 (outliers are removed based on three standard deviations), deflated by national CPI index, over the period 1972 to 1993. WorkRight is a binary variable, taking the value of one in each state, after the earliest of the three exceptions for wrongful discharges is established. Knowledge is the industry average use of intangible assets relative to fixed assets. State as well as year fixed effects are included for column 1 (not reported). For columns 2, state-year and state-industry fixed effects are included (not reported). T-statistics based on robust standard errors are reported (collected for clustering at the state level for column 2): * denotes significant at 10%; ** at 5%; and *** at 1%.

	State Growth	State-Industry Growth
	[1]	[2]
WorkRight	-0.174	
	[-0.267]	
WorkRight*Knowledge		1.417
		[6.510]***
N	1008	49204
R-squared	0.368	0.176

Table 3. State-Industry Level Regressions (1972-1993)

The dependent variable is the real growth rate of gross state-industry product, deflated by national CPI index, over the period 1972 to 1993 (outliers are removed based on three standard deviations). WorkRight is a binary variable, taking the value of one in each state, after the earliest of the three exceptions for wrongful discharges is established. Knowledge is the industry average use of intangible assets relative to fixed assets. FinLib is M&A based bank branch deregulation in each state. It is a binary variable, taking the value of one if deregulated. ExtFinDep is the industry level tendency of external finance defined in Rajan-Zingales (1998), calculated as the mean of median of each year from 1991 to 2006 using the Worldscope database. State-year and state-industry fixed effects are included, but not reported. The reported t-statistics are based on robust standard errors corrected for clustering at the state level: * denotes significant at 10%; ** at 5%; and *** at 1%.

Knowledge proxy:	*Intangible / Fixed Assets*			
	[1]	[2]	[3]	[4]
WorkRight*Knowledge	1.417		1.490	1.333
	[6.510]***		[6.696]***	[5.217]***
FinLib*ExtFinDep		0.042	0.123	-0.012
		[0.685]	[1.979]**	[-0.118]
WorkRight*FinLib*Knowledge				0.443
				[1.795]*
WorkRight*FinLib*ExtFinDep				0.200
				[2.194]**
N	49204	50067	49204	49204
R-squared	0.176	0.175	0.176	0.176

Table 4. State-Industry Level Regressions with Alternative Definitions of Knowledge Intensity (1972-1993)

The dependent variable is the real growth rate of gross state-industry product, deflated by national CPI index, over the period 1972 to 1993 (outliers are removed based on three standard deviations). WorkRight is a binary variable, taking the value of one in each state, after the earliest of the three exceptions for wrongful discharges is established. Knowledge is sales to fixed asset ratio, or employment share of college graduates. FinLib is M&A based bank branch deregulation in each state. It is a binary variable, taking the value of one if deregulated. ExtFinDep is the industry level tendency of external finance defined in Rajan-Zingales (1998), calculated as the mean of median of each year from 1991 to 2006 using the Worldscope database. State-year and state-industry fixed effects are included, but not reported. The reported t-statistics are based on robust standard errors corrected for clustering at the state level: * denotes significant at 10%; ** at 5%; and *** at 1%.

Knowledge proxy:	*Sales / Fixed Assets*			*Share of College Graduates*		
	[1]	[2]	[3]	[4]	[5]	[6]
WorkRight*Knowledge	0.106	0.116	0.090	4.233	4.262	4.504
	[5.279]***	[5.415]***	[3.791]***	[4.443]***	[4.439]***	[3.459]***
FinLib*ExtFinDep		0.123	-0.007		0.026	0.006
		[1.908]*	[-0.066]		[0.433]	[0.066]
WorkRight*FinLib*Knowledge			0.078			0.022
			[2.450]**			[0.255]
WorkRight*FinLib*ExtFinDep			0.246			-0.344
			[2.362]**			[-0.257]
N	49204	49204	49204	42484	42484	42484
R-squared	0.176	0.176	0.176	0.177	0.177	0.177

Table 5. State-Industry Level Regressions (Panel GMM, 1972-1993)

The dependent variable is the real growth rate of gross state-industry product, deflated by national CPI index, over the period 1972 to 1993 (outliers are removed based on three standard deviations). WorkRight is a binary variable, taking the value of one in each state, after the earliest of the three exceptions for wrongful discharges is established. Knowledge is the industry average use of intangible assets relative to fixed assets, sales to fixed asset ratio. or employment share of college graduates. FinLib is M&A based bank branch deregulation in each state. It is a binary variable, taking the value of one if deregulated. ExtFinDep is the industry level tendency of external finance defined in Rajan-Zingales (1998), calculated as the mean of median of each year from 1991 to 2006 using the Worldscope database. Estimation is based on Blundell and Bond (1998) with AR(1) or AR(2) terms in difference equations. Year dummies are included, but not reported. T-statistics based on two-step GMM standard errors are reported: * denotes significant at 10%; ** at 5%; and *** at 1%.

Knowledge proxy:	*Intangible / Fixed Assets*			*Sales / Fixed Capital*			*Share of College Graduates*		
	AR(1)	*AR(1)*	*AR(2)*	*AR(1)*	*AR(1)*	*AR(2)*	*AR(1)*	*AR(1)*	*AR(2)*
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
WorkRight	-0.533	-0.605	-0.875	-0.013	0.130	-0.265	-3.326	-3.486	-3.840
	[-2.964]***	[-2.592]***	[-3.636]***	[-0.074]	[0.575]	[-1.140]	[-13.507]***	[-9.629]***	[-10.354]***
WorkRight*Knowledge	1.868	1.726	1.757	0.110	0.081	0.082	13.324	13.843	14.326
	[13.520]***	[8.431]***	[8.586]***	[7.536]***	[3.945]***	[3.991]***	[22.291]***	[14.293]***	[14.542]***
FinLib	1.053	0.843	0.784	1.039	0.904	0.779	0.819	0.705	0.655
	[8.145]***	[4.171]***	[3.631]***	[7.951]***	[4.450]***	[3.611]***	[6.302]***	[3.323]***	[2.913]***
FinLib*ExtFinDep	0.074	-0.096	-0.071	0.051	-0.103	-0.072	-0.001	-0.138	-0.113
	[1.835]*	[-1.586]	[-1.167]	[1.306]	[-1.674]*	[-1.167]	[-0.020]	[-2.254]**	[-1.813]*
WorkRight*FinLib		-0.093	0.103		-0.263	-0.120		0.347	0.808
		[-0.280]	[0.302]		[-0.811]	[-0.362]		[0.721]	[1.654]*
WorkRight*FinLib*Knowledge		0.452	0.219		0.090	0.068		-0.632	-1.790
		[1.628]	[0.785]		[3.031]***	[2.271]**		[-0.501]	[-1.411]
WorkRight*FinLib*ExtFinDep		0.278	0.250		0.312	0.266		0.198	0.182
		[3.707]***	[3.307]***		[3.899]***	[3.305]***		[2.685]***	[2.446]**
N	45958	45958	42967	45958	45958	42967	39705	39705	37133
N Groups	2428	2428	2417	2428	2428	2417	2096	2096	2086
Sargan (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
m1 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
m2 (p-value)	0.047	0.029	0.070	0.053	0.052	0.071	0.077	0.076	0.067

Table 6. State-Industry Level Regressions with Other Labor Protections (1983-1993)

The dependent variable is the real growth rate of gross state-industry product, deflated by national CPI index, over the period 1983 to 1993 unless otherwise noted (outliers are removed based on three standard deviations). WorkRight is a binary variable, taking the value of one in each state, after the earliest of the three exceptions for wrongful discharges is established; state-specific union coverage rate (percentage of workforce covered by collective bargaining); or minimum wage level adjusted for CPI inflation. Knowledge is the industry average use of intangible assets relative to fixed assets. FinLib is M&A based bank branch deregulation in each state. It is a binary variable, taking the value of one if deregulated. ExtFinDep is the industry level tendency of external finance defined in Rajan-Zingales (1998), calculated as the mean of median of each year from 1991 to 2006 using the Worldscope database. State-year and state-industry fixed effects are included, but not reported. The reported t-statistics are based on robust standard errors corrected for clustering at the state level: * denotes significant at 10%; ** at 5%; and *** at 1%.

WorkRight proxy:	*Exception for Wrongful Discharges*		*Union Coverage Ratio*		*Minimum Wage Level*		*Minimum Wage Level*	
Knowledge proxy:	*Intangible / Fixed Assets*		*Intangible / Fixed Assets*		*Intangible / Fixed Assets*		*Intangible / Fixed Assets*	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
							(1972-1993 data)	
WorkRight*Knowledge	0.448	-0.066	-0.156	-0.154	-1.308	-1.335	*-0.343*	*-0.129*
	[0.510]	[-0.076]	[-2.916]***	[-3.011]***	[-4.779]***	[-4.195]***	*[-3.286]****	*[-1.026]*
FinLib*ExtFinDep	0.270	0.068	0.309	0.519	0.344	0.959	*0.082*	*0.307*
	[2.694]***	[0.432]	[3.226]***	[2.617]***	[3.437]***	[2.140]**	*[1.329]*	*[1.598]*
WorkRight*FinLib*Knowledge		1.074		0.036		0.082		*0.284*
		[2.832]***		[1.416]		[1.069]		*[5.621]****
WorkRight*FinLib*ExtFinDep		0.338		-0.013		-0.117		*-0.018*
		[2.462]**		[-0.910]		[-1.357]		*[-0.503]*
N	23536	23536	23957	23957	23957	23957	*50067*	*50067*
R-squared	0.212	0.212	0.211	0.211	0.211	0.211	*0.175*	*0.176*