Skills and the Regulation of Labor

Diogo Baerlocher
University of South Florida

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Motivation

- Standards of living differ considerably across countries.
- In 2019, according to the Penn World Table, real GDP per capita (expenditure side) ranged from ***US$251 in Venezuela*** to ***US$112,941 in Luxembourg***.
- The ratio between the countries in the 90^{th} (Germany) and 10^{th} (Togo) percentiles of the distribution is about 25.
  ↳ Individuals in Germany enjoy, on average, 25 times more goods and services than those in Togo.

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- The ratio between the countries in the 90^{th} (Germany) and 10^{th} (Togo) percentiles of the distribution is about 25.
  ↳ Individuals in Germany enjoy, on average, 25 times more goods and services than those in Togo.
- Understanding these differences remains a challenge for economists.
  ↳ The debate currently stands between those who argue for ***better measures of human capital*** and those who attribute large productivity differences to ***alternative institutional arrangements***, such as labor market regulation.

This paper

- This paper explores the connection between labor market regulation and the share of skilled workers in the economy.
- The main results are:
  1. I document a positive correlation between the share of skilled workers and the weakening of labor regulations in the second half of the twentieth century.
  2. I show theoretically that this is possible because skilled workers benefit from a larger number of employed unskilled workers.
  3. Using the epidemiological transition of the 1930s as an exogenous shock to human capital composition, I estimate the causal relationship between the share of skilled workers and labor regulation.
- These findings contribute to our understanding of human capital as an indirect driving force of economic development.

Literature

- This paper is close in spirit to Nelson and Phelps (1966), which points to human capital as a source of increasing technological progress.
  ↳ My paper highlights human capital as a source of increased productivity through reduced labor market regulation.

- I extend the framework proposed by Saint-Paul (1998), where there is internal conflict between skilled and unskilled workers.
  ↳ The model in this paper allows for ***multiple workers within a firm***, which is more suitable for ***quantitative analysis***.

- The paper is also similar in spirit to Acemoglu, Aghion and Violante (2001) and Dinlersoz and Greenwood (2016), which show that the decline in union power can be attributed to the increased share of skilled workers.

Facts

Facts

- After the creation of the International Labor Organization and the strengthening of welfare states in Europe, pro-worker regulations became more common after the Second World War.
  ↳ Strong pro-worker regulation peaked in the 1970s and began to decline in the 1990s.

- To obtain a general picture of this trend, I rely on data from the Fraser Institute's Economic Freedom dataset (Gwartney, Lawson and Hall, 2017).

- The dataset contains an index measuring the level of freedom in the labor market, with higher values indicating less pro-worker regulation.
  ↳ ***I invert the index*** so that higher values indicate more pro-worker regulation.

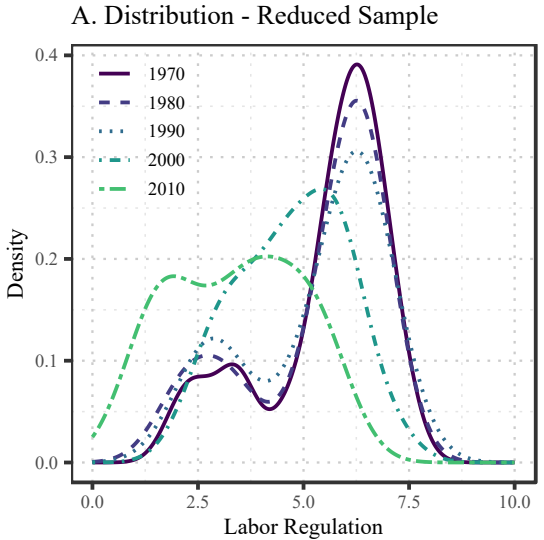
- Therefore, countries with greater benefits for workers—such as higher firing costs and stronger bargaining power—have larger values.

Facts

- The data are provided in 10-year intervals from 1970 to 2010; however, only a small set of developed countries have observations for all years.
- I divide the analysis into two samples:
  - ↳ ***Reduced sample:*** 20 developed countries with complete data from 1970 to 2010.
  - ↳ ***Full sample:*** 45 developed and developing countries with data from 1990 to 2010.

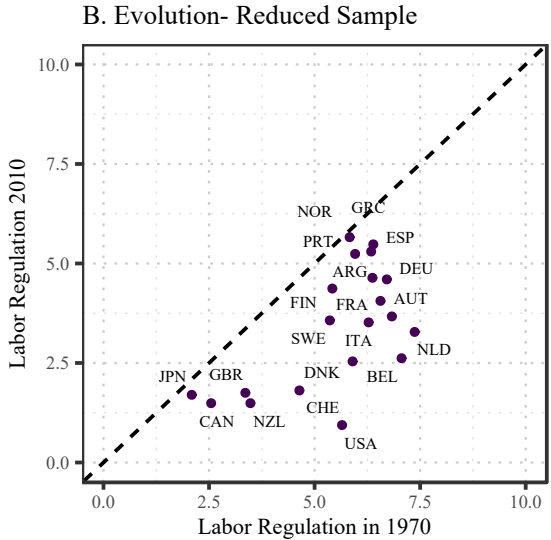
Facts

- The figure shows the evolution of the distribution of labor regulation from 1970 to 2010 in the reduced sample.
- The index peaks around 6 in 1970 and shows little change in 1980 and 1990.
- Substantial reductions occur in 2000 and 2010.



Facts

- This figure shows the evolution of each country in the sample from 1970 to 2010.
- With a few exceptions (Japan, Canada, Great Britain, New Zealand), countries had a labor regulation index around 6 in 1970.
- Many of them, such as the United States, Switzerland, and Belgium, experienced significant reductions by 2010.
- Others, such as Greece, Portugal, and Spain, showed little change.



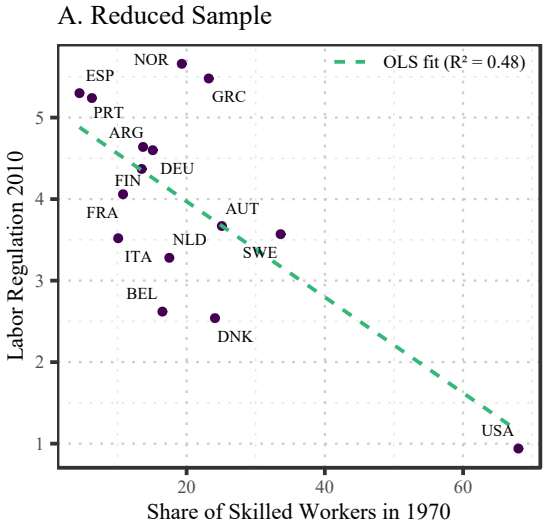
Facts

- The next question is whether the share of skilled workers helped countries weaken their labor market regulations.
- To measure the share of skilled workers, I use data on ***educational attainment*** from Lee and Lee (2016).
- The share of skilled workers is defined as the proportion of individuals between 25 and 65 years of age with at ***least secondary education***.

  ↳ In the empirical analysis, I show that the results are similar when I consider the share of workers with at ***least a bachelor's degree***.

Facts

- The figure shows the correlation between the share of skilled workers in 1970 and labor market regulation in 2010 in the reduced sample for countries with a ***labor regulation index above 5 in 1970***.
- Countries with similar labor regulation indexes in 1970 experienced stronger declines in the index when their share of skilled workers was larger.
- The overall trend is similar in the full sample.



Winners and losers from labor regulation

Structure

- The goal here is to show one theory in which there is conflict between skilled and unskilled workers in supporting labor market regulations.
  - ↳ Labor market regulation is also likely to increase the share of skilled workers.

- I do not seek to fully quantify the evolution of labor market regulation nor the evolution of the share of skilled workers. The causal relationship of share of skilled workers and labor market regulation will be tested in the next section.

- The economy has a measure-one continuum of risk-neutral individuals where a share χ is skilled and n is unskilled.

- A representative firm owned by skilled workers produces output $f(h, \ell)$, where h is the share of skilled workers and ℓ is the share of unskilled workers hired.

  ↳ $f : \mathbb{R}^2 \to \mathbb{R}$ is continuous, strictly increasing, and strictly concave in both arguments, and satisfies the standard Inada conditions and other asymptotic properties necessary to guarantee the existence of a unique steady-state equilibrium. Assumptions

Structure

- As in Saint-Paul (1998), the skilled labor market is competitive while the unskilled labor market features search frictions and wage bargaining.

  ↳ To hire unskilled workers, the firm posts vacancies v at a convex cost function $c(v)$, which are converted into employment by the matching function $m(v, u)$, where u denotes unemployed workers.

- The matching rates $p(\theta) := m(u, v)/u = m(1, \theta)$ and $q(\theta) := m(u, v)/v = m(1/\theta, 1)$ depend on ***market tightness*** $\theta := v/u$, taken as given by workers and the firm but endogenously determined.

Structure

- The ***value of the firm*** that employs h skilled and ℓ unskilled workers is defined as

$$\mathcal{J}(h,\ell) = \underbrace{\pi(h,\ell)}_{\text{period profit}} + \max_{v\geq 0}\{-c(v) + \beta\mathcal{J}(h',\ell')\} \quad \text{s.t.} \quad \ell' = (1-\delta)\ell + vq(\theta),$$

  where δ is the exogenous separation rate and β is the discount factor. There is full employment of skilled workers: $h = \chi$.

Structure

- The ***value of an unskilled worker*** employed in a firm with h skilled and ℓ unskilled workers is

$$\mathcal{V}(h,\ell) = w(h,\ell) + \delta\beta\mathcal{U}' + (1-\delta)\beta\mathcal{V}(h',\ell'),$$

  where the ***value of unemployment*** is

$$\mathcal{U} = b + p(\theta)\beta\mathcal{V}(h',\ell') + (1-p(\theta))\beta\mathcal{U}',$$

  with b denoting the home-production value.

- The ***value of a skilled worker*** in a firm with h skilled and ℓ unskilled workers is

$$\mathcal{W}(h,\ell) = x(h,\ell) + \mathcal{J}(h,\ell)/h + \beta\big(\mathcal{W}(h',\ell') + \mathcal{J}(h',\ell')/h'\big).$$

Wage Bargaining

- Let φ be the bargaining power of unskilled workers. The bargaining solution allocates a share φ of the surplus to the unskilled worker and the remaining share $1-\varphi$ to the firm. Then

$$\varphi \underbrace{\mathcal{J}_\ell(h,\ell)}_{\substack{\text{Marginal}\\ \text{Benefit of Hiring}}} = (1-\varphi)\big(\mathcal{V}(h,\ell) - \mathcal{U}\big).$$

- Together with the optimal vacancy condition, we find the wage rates:

$$x(h,\ell) = f_h(h,\ell) - \ell^{-\frac{1}{\varphi}+1} \int_0^\ell \lambda^{\frac{1}{\varphi}-1} f_{\ell h}(h,\lambda)\, d\lambda,$$

$$w(h,\ell) = (1-\varphi)\big(\mathcal{U} - \beta\mathcal{U}'\big) + \ell^{-\frac{1}{\varphi}} \int_0^\ell \lambda^{\frac{1}{\varphi}-1} f_\ell(h,\lambda)\, d\lambda.$$

Wage Bargaining

- Skilled workers receive their marginal product discounted by their effect on the wage rate of unskilled workers.

  ↳ More skilled workers imply more productive unskilled workers, which in turn implies higher wages for unskilled workers.

- Unskilled workers receive a combination of their outside option and the average marginal product.

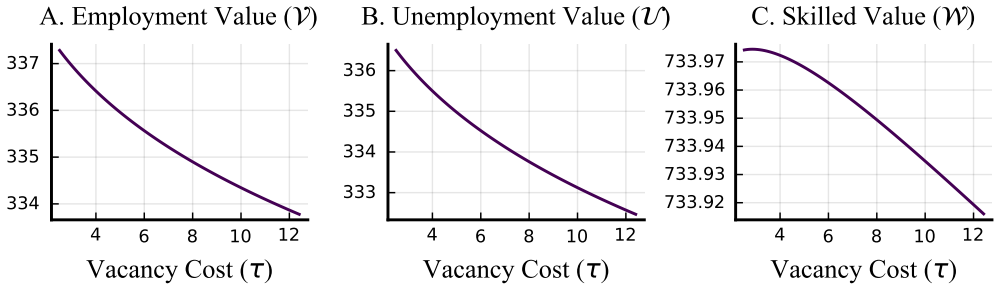
  ↳ If bargaining power is small ($\rightarrow 0$), unskilled workers are paid their outside option. If it is large ($= 1$), unskilled workers are paid the average marginal product.

- All analysis is done at steady state. Full SS Definition

Numerical Analysis

Calibration

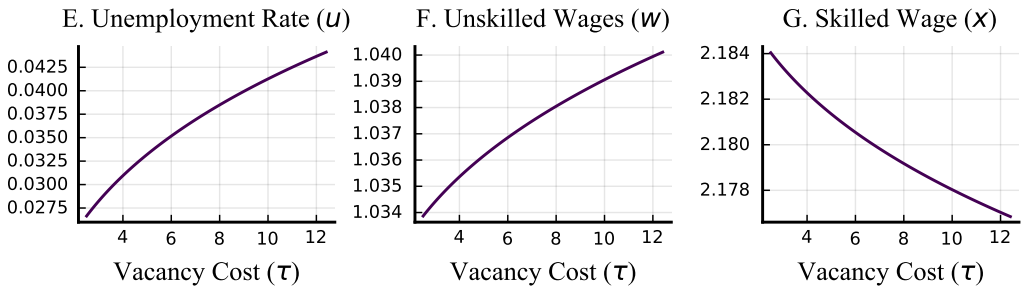
Changes in vacancy cost



- All workers are worse off after increases in labor regulation.
- The effect on unemployed workers is especially large, which drives the value of employment.
  ↳ That is, the probability of being unemployed combined with forward-looking behavior drives the negative effect on unskilled workers.

Numerical Analysis

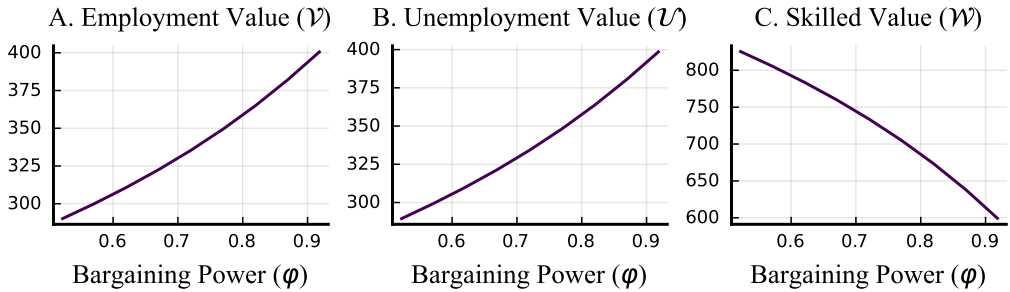
Changes in vacancy cost



- Unemployment increases when labor regulation rises.
- As discussed, unskilled wages increase while skilled wages decrease.

Numerical Analysis

Changes in bargaining power

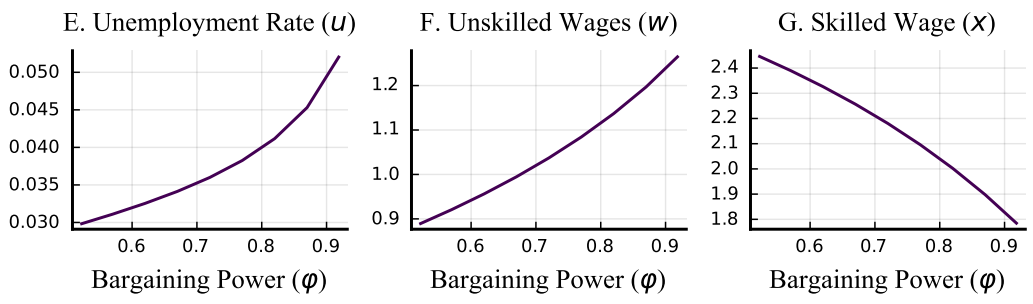


- In this case, unemployed workers are better off since they can obtain higher wages when they find a job. Again, this drives the value of unskilled workers.

- Skilled workers are worse off due to lower wages and profits.

Numerical Analysis

Changes in bargaining power



- The effects on unemployment and wages are similar.

Winners and Losers from Labor Regulation

- The model shows that whether a conflict exists between skilled and unskilled workers depends on the type of labor regulation.
- It also depends heavily on how workers value the future relative to the present.
  - ↳ If workers only care about current wages, the conflict exists regardless of the type of regulation.
- One option to "test" the model is to model the politics of regulation determination and check if it matches the previously observed facts.
- Instead, I pursue an empirical approach to show that the correlations presented earlier are causal.

Empirical Evidence

Epidemiological Transition and Share of Skilled Workers

- Improvements in life expectancy are a well-documented fact of the twentieth century.
- The connection between health improvements and the share of skilled workers arises because these improvements did not spread evenly across populations.
  - ↳ Higher increases in survival rates occurred in less educated households.
  - ↳ Increases in survival rates led to higher numbers of surviving children (Doepke, 2005).
  - ↳ Low-skilled parents are less likely to educate their offspring (Kremer and Chen, 2002; Moav, 2005).
- This connection was previously studied by Cervellati and Sunde (2015).

Epidemiological Transition and Share of Skilled Workers

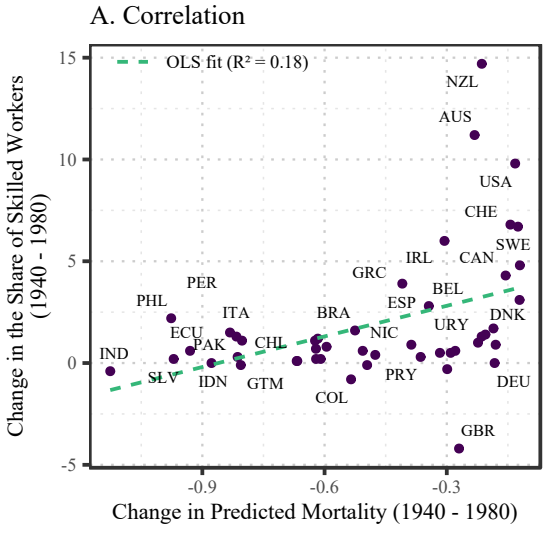
- Acemoglu and Johnson (2007) use ***predicted mortality*** from a set of diseases whose treatments advanced after the 1940s as an instrument for health improvements:

$$M_{i,t}^{I} = \sum_{d \in \mathcal{D}} \left[(1 - I_{d,t}) M_{di,1940} + I_{d,t} M_{dF,t} \right]$$

- $M_{di,1940}$ is the mortality from disease d in 1940, $I_{d,t}$ indicates whether there was a medical intervention for d, and $M_{dF,t}$ is the mortality in the "frontier" country.

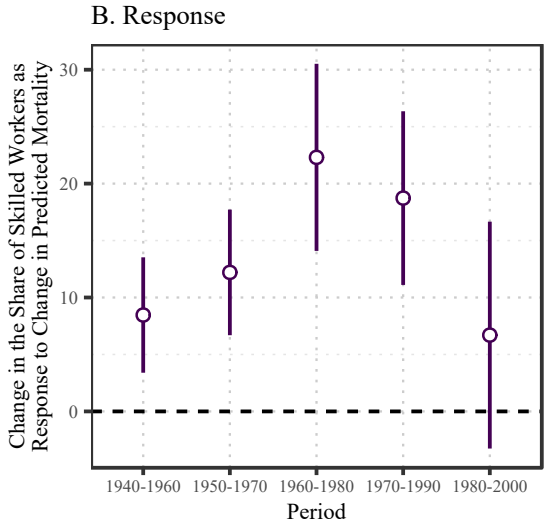
Epidemiological Transition and Share of Skilled Workers

- Countries with larger decreases in predicted mortality experience smaller increases in the share of skilled workers.



Epidemiological Transition and Share of Skilled Workers

- This effect becomes stronger after a few decades, when newborns enter the labor force.



Share of Skilled Workers and Labor Regulation

- The previous analysis represents the first stage of my instrumental variable approach. Formally:

$$\text{Share of Skilled Workers}_{i,t} = \varsigma_0 + \varsigma_1 \text{Predicted Mortality}_{i,t-1} + \nu_{i,t},$$

$$\text{Labor Regulation}_{i,t} = \alpha_0 + \alpha_1 \text{Labor Regulation}_{i,t-1} + \alpha_2 \text{Share of Skilled Workers}_{i,t-1} + \varepsilon_{i,t}$$

- The inclusion restriction holds. The exclusion restriction depends on whether other factors affecting labor regulation are correlated with predicted mortality. First Stage Estimates

- One potential concern is that predicted mortality could directly influence development, but Acemoglu and Johnson (2007) show that this is not the case.

Share of Skilled Workers and Labor Regulation

- Estimating α_2 requires three time periods.
- In the ***full sample***, labor regulation data are available for 1990 and 2010, the share of skilled workers for 1990, and predicted mortality for 1970.
  - ↳ Cannot control for time-invariant unobservables in this setup.
- I rely on the ***reduced sample***, which contains regulation data for 1970, 1990, and 2010.

Share of Skilled Workers and Labor Regulation

Panel A: Secondary Complete				
	(1)	(2)	(3)	(4)
Dependent Variable: Labor Regulation				
Share of Skilled Workers	-0.0407***	-0.0818***	-0.0752***	-0.1234***
	(0.0066)	(0.0060)	(0.0089)	(0.0155)
Country Fixed Effect			✓	✓
Observations	60	60	40	40
Countries	40	40	20	20
First-Stage F Stat.		83.586		22.518

Share of Skilled Workers and Labor Regulation

Panel B: College Complete				
	(1)	(2)	(3)	(4)
Dependent Variable: Labor Regulation				
Share of Skilled Workers	-0.1318***	-0.3609***	-0.2228***	-0.4091***
	(0.0261)	(0.0329)	(0.0426)	(0.0904)
Country Fixed Effect			✓	✓
Observations	60	60	40	40
Countries	40	40	20	20
First-Stage F Stat.		76.229		19.054

Conclusions

Conclusions

- I've documented a positive correlation between the share of skilled workers and the weakening of labor regulations in the second half of the twentieth century
- I show that, theoretically, this is possible because skilled workers benefit from a larger number of employed unskilled workers
- Using a epidemilogical transition of the 1930s as an exogenous shock to human capital composition, I estimate the causal relationship between the share of skilled workers and labor regulation
- Investments in human capital not only raise productivity but can also influence the political economy of labor markets.

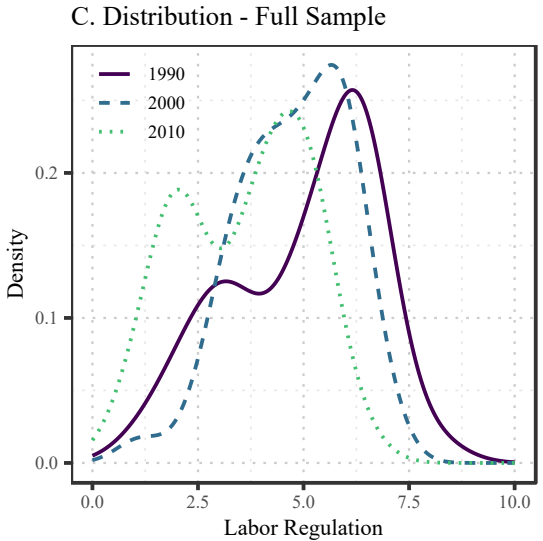
Thank You!

Diogo Baerlocher
University of South Florida
baerlocher@usf.edu

Backup Slides

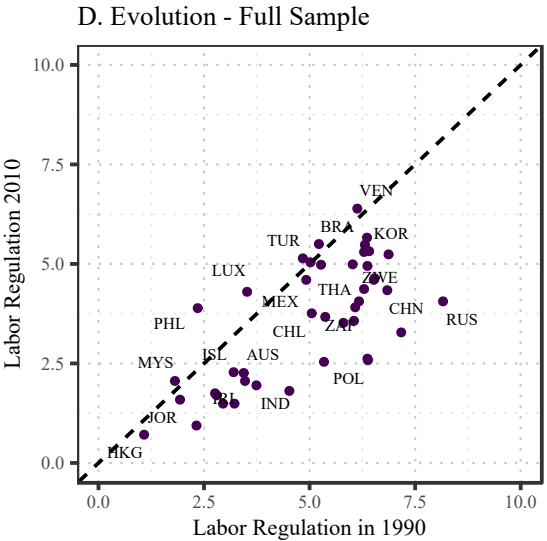
Facts back

- The overall trend is similar in the full sample.
- The labor market index peaks around 6 in 1990 and declines in 2000 and 2010.



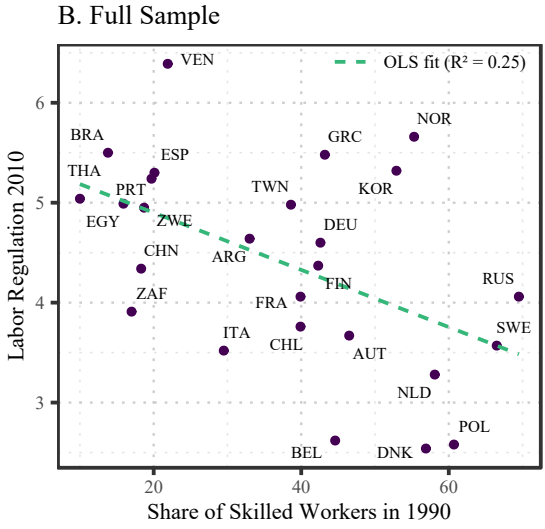
Facts back

- Several developing countries, such as Poland, China, and India, successfully reformed their labor regulations between 1990 and 2010.
- Others, such as Brazil, Turkey, and Venezuela, experienced little change.



Facts back

- This correlation is similar but somewhat weaker in the full sample.



Assumptions back

The production function $f(\cdot,\cdot)$ satisfies the following additional conditions, where subscripts denote partial derivatives:

1. $\lim_{\ell\to 0} \ell^{-\frac{1}{\varphi}+1} \int_0^\ell \lambda^{\frac{1}{\varphi}-1} f_\ell(h,\lambda)d\lambda = 0$;
2. $f_\ell(h,\ell) - f_{\ell h}(h,\ell)h$ is strictly decreasing in ℓ;
3. $\lim_{\ell\to 0} [f_\ell(h,\ell) - f_{\ell h}(h,\ell)h] > 0$.

Steady State Equilibrium Definition I

A steady state equilibrium with unemployment is a set of endogenous aggregate variables $\{\theta_{ss}, \mathcal{U}_{ss}, v_{ss}, h_{ss}, \ell_{ss}\}$, a set of wage functions $\{w_{ss}, x_{ss}\}$, and set of values functions $\{\mathcal{J}_{ss}, \mathcal{V}_{ss}, \mathcal{W}_{ss}\}$ such that

1. Skilled labor market clearing implies $h_{ss} = \chi$;
2. Given $\theta_{ss} := v_{ss}/u_{ss}$ and $v_{ss} = \delta \ell_{ss}/q(\theta_{ss})$, the equilibrium unemployment rate is given by $u_{ss} = \delta n/(p(\theta_{ss}) + \delta)$ and implies $\ell_{ss} = p(\theta_{ss})n/(\delta + p(\theta_{ss}))$;
3. Given θ_{ss} and v_{ss}, the steady state value of unemployment is

$$\mathcal{U}_{ss} = \frac{b}{1-\beta} + \frac{1}{1-\beta}\frac{\varphi}{1-\varphi}\frac{p(\theta_{ss})}{\beta q(\theta_{ss})}c_v(v_{ss});$$

Steady State Equilibrium Definition II

4. Given the set of endogenous aggregate variables, the steady state wages are defined by

$$x(h,\ell) = f_h(h,\ell) - \ell^{-\frac{1}{\varphi}+1} \int_0^{\ell} \lambda^{\frac{1}{\varphi}-1} f_{\ell h}(h,\lambda)\, d\lambda,$$

$$w(h,\ell) = (1-\varphi)\left(\mathcal{U} - \beta\mathcal{U}'\right) + \ell^{-\frac{1}{\varphi}} \int_0^{\ell} \lambda^{\frac{1}{\varphi}-1} f_{\ell}(h,\lambda)\, d\lambda.$$

with $h = h_{ss}$, $\ell = \ell_{ss}$ and $\mathcal{U} = \mathcal{U}' = \mathcal{U}_{ss}$;

Steady State Equilibrium Definition III

5. Given the set of endogenous aggregate variables and wage functions, the set of value functions satisfy

$$
\begin{aligned}
(1-\beta)\mathcal{J}_{ss}(h_{ss},\ell_{ss}) &= f(h_{ss},\ell_{ss}) - x(h_{ss},\ell_{ss})h_{ss} - w(h_{ss},\ell_{ss})\ell_{ss} - c(v_{ss}) \\
(1-\beta(1-\delta))\mathcal{V}_{ss}(h_{ss},\ell_{ss}) &= w_{ss}(h_s s,\ell_{ss}) + \delta\beta\mathcal{U}_{ss} \\
(1-\beta)\mathcal{W}_{ss}(h_{ss},\ell_{ss}) &= x_{ss}(h_{ss},\ell_{ss}) + (1-\beta)\mathcal{J}_{ss}(h_{ss},\ell_{ss})/h_{ss};
\end{aligned}
$$

Steady State Equilibrium Definition IV

6. Given θ_{ss}, v_{ss} and $\mathcal{J}_{ss}$, optimal vacancy posting condition

$$\varphi \mathcal{J}_\ell(h, \ell) = (1 - \varphi)(\mathcal{V}(h, \ell) - \mathcal{U}),$$

holds and can be written as

$$\pi_\ell(h_{ss}, \ell_{ss}) = \frac{(1 - \beta(1 - \delta))}{\beta} \frac{c_v(v_{ss})}{q(\theta_{ss})}.$$

back

Numerical Analysis back

Functional forms

- From the labor literature:

$$f(h, \ell) = z[\gamma h^{\rho} + (1 - \gamma)\ell^{\rho}]^{\frac{1}{\rho}},$$

where $0 < \rho < 1$ determines the elasticity of substitution $\sigma = 1/(1 - \rho)$.

- From Acemoglu and Hawkins (2014):

$$c(v) = 0.5\tau v^2,$$

where τ is the exogenous cost of posting a vacancy, used to simulate changes in labor regulation.

- From the literature on search frictions, set

$$m(u, v) = \zeta u^{\eta} v^{1-\eta}.$$

Numerical Analysis

Calibration back

- The model period is one month, aligning with the search frictions literature. Skilled workers are defined as college graduates, consistent with the labor literature.

Parameter	Definition	Description
$\beta = 0.997$	monthly discount factor	annual interest rate of 4%
$\rho = 0.3827$	production function param.	aggregate elasticity of substitution between college and high-school equivalents equal to 1.64 (Autor, Katz and Kearney, 2008)
$\eta = 0.72$	matching function param.	following (Shimer, 2005)
$\varphi = 0.72$	workers' bargaining power	following (Shimer, 2005)
b	home production	$b/(1-\beta) = 0.4\mathcal{U}_{ss}$ (Acemoglu and Hawkins, 2014)
$\chi = 0.33$	share of skilled workers	US labor force 2007

Numerical Analysis

Calibration back

Parameter	Definition	Description
$z = 3.467$	productivity	normalization $(1-\beta)\mathcal{U} = 1$
$\tau = 6.462$	cost of posting a vacancy	normalization $(1-\beta)\mathcal{U} = 1$
$\zeta = 0.5635$	efficiency of $m(\cdot,\cdot)$	matches unemployment of unskilled workers at 3.6% in the US
$\gamma = 0.73$	relative productivity of college graduates	matches college premium of 1.97 (Acemoglu and Autor, 2011)
$\delta = 0.032$	monthly separation rate of unskilled workers	following (Wolcott, 2021)

First-Stage Estimation

back

	Secondary Complete		College Complete	
	(1)	(2)	(3)	(4)
Dependent Variable: Share of Skilled Workers				
Predicted Mortality	-1.844***	-1.258***	-0.4177***	-0.3793***
	(0.2017)	(0.2650)	(0.0478)	(0.0869)
Country Fixed Effect		✓		✓
Observations	60	40	60	40
Countries	40	20	40	20
First-Stage F Stat.	83.586	22.518	76.229	19.054

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