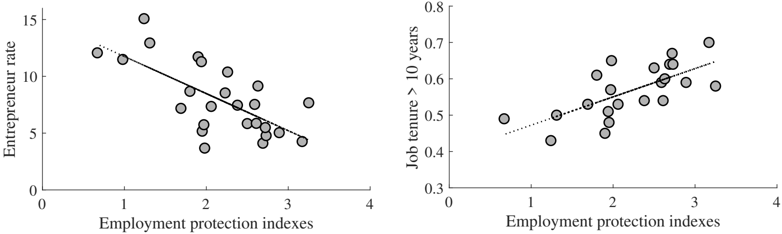
Employment Protection and Entrepreneurship in a Schumpeterian Growth Model

Mitsuru Katagiri
Hosei University

May 29, 2023
@CIGS conference

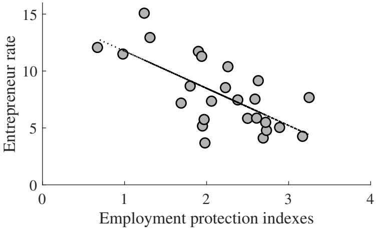
Employment Protection (EPL) vs. Entrepreneurship

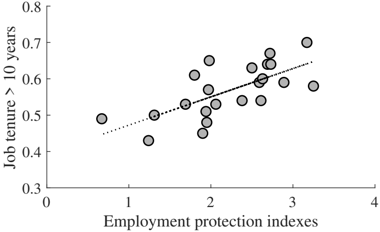


Note: The figure shows cross-country scatter plots between the employment protection indexes constructed by OECD and the entrepreneur ratios in the global entrepreneurship monitor (left) or the number of workers whose job tenure is longer than ten years (right) for countries whose GDP per capita is larger than 20 thousand USD.

- EPL suppresses entrepreneurship while extending job tenure and encouraging human capital accumulation. Table

Employment Protection (EPL) vs. Entrepreneurship





Note: The figure shows cross-country scatter plots between the employment protection indexes constructed by OECD and the entrepreneur ratios in the global entrepreneurship monitor (left) or the number of workers whose job tenure is longer than ten years (right) for countries whose GDP per capita is larger than 20 thousand USD.

- EPL suppresses entrepreneurship while extending job tenure and encouraging human capital accumulation. Table
- Does EPL suppress economic growth through this channel?

Growth by Firm Age

- To what extent young firms grow more is key to assessing the impact of entrepreneurship on economic growth.
- Previous empirical studies show that young firms grow more than old ones, e.g., Haltiwanger et al. (2013).
- We use confidential firm-level microdata for Japanese firms.
  - ⋆ METI has conducted a *"Basic Survey of Japanese Business Structure and Activities"* since 1997.
  - ⋆ The dataset contains yearly financial information for all firms in Japan that hire more than 50 employees.

Growth by Firm Age

- The relationship between firm growth and age is estimated by:

$$\Delta \text{Sale}_{i,t} = \alpha + Year_t + \sum_{\bar{a}=1}^{15} \beta_{\bar{a}} \times D(\bar{a})_{i,t} + \gamma X_{i,t-1} + \varepsilon_{i,t}$$

where $D(\bar{a})_{i,t} = 1 \;\; \textit{if} \;\; 5(\bar{a}-1) < \text{Firm } i\text{'s age} \leq 5\bar{a}$

Growth by Firm Age

- The relationship between firm growth and age is estimated by:

$$\Delta \mathrm{Sale}_{i,t} = \alpha + Year_t + \sum_{\bar{a}=1}^{15} \beta_{\bar{a}} \times D(\bar{a})_{i,t} + \gamma X_{i,t-1} + \varepsilon_{i,t}$$

where $D(\bar{a})_{i,t} = 1 \;\; if \;\; 5(\bar{a}-1) < \text{Firm } i\text{'s age} \leq 5\bar{a}$

- Younger firms significantly grow more than older ones.

$\bar{a}$	1	2	3	4	5	6	7	8	9	10
$\beta_{\bar{a}}$	.048** (.006)	.032** (.005)	.021** (.005)	.019** (.004)	.012** (.004)	.005 (.004)	.003 (.003)	.001 (.003)	.001 (.003)	.002 (.002)

- The estimation results about firm growth by age are used as moment conditions to be matched in indirect inference.

What I Do

What I Do

- Construct a tractable Schumpeterian growth model with:
  - ⋆ Different growth potential by firm age,
  - ⋆ Incremental innovation on existing products to survive, i.e., the escape-entry effects (Aghion et al. 2009), Estimation
  - ⋆ Households' entrepreneurial decision and two types of human capital (firm-specific and general; FSHC and GHC).

What I Do

- Construct a tractable Schumpeterian growth model with:
  - ⋆ Different growth potential by firm age,
  - ⋆ Incremental innovation on existing products to survive, i.e., the escape-entry effects (Aghion et al. 2009), Estimation
  - ⋆ Households' entrepreneurial decision and two types of human capital (firm-specific and general; FSHC and GHC).
- Calibrate parameter values by indirect inference using firm- and household-level microdata in Japan.

What I Do

- Construct a tractable Schumpeterian growth model with:
  - ⋆ Different growth potential by firm age,
  - ⋆ Incremental innovation on existing products to survive, i.e., the escape-entry effects (Aghion et al. 2009), ▸ Estimation
  - ⋆ Households' entrepreneurial decision and two types of human capital (firm-specific and general; FSHC and GHC).
- Calibrate parameter values by indirect inference using firm- and household-level microdata in Japan.
- Investigate the effects of EPL on entrepreneurship and growth by asking: What if ELP is eliminated in Japan?

Preview of Main Results

Preview of Main Results

- EPL suppresses entrepreneurship, as it helps accumulate FSHC and thus increases the opportunity cost.

Preview of Main Results

- EPL suppresses entrepreneurship, as it helps accumulate FSHC and thus increases the opportunity cost.
- Eliminating EPL has sizable effects on economic growth.
  - ⋆ If EPL in Japan were to be eliminated as in the U.S., the economic growth rate would rise by 0.2%pts.
  - ⋆ An increase in new entries raises the share of young firms with more growth potential.

Preview of Main Results

- EPL suppresses entrepreneurship, as it helps accumulate FSHC and thus increases the opportunity cost.
- Eliminating EPL has sizable effects on economic growth.
  - ⋆ If EPL in Japan were to be eliminated as in the U.S., the economic growth rate would rise by 0.2%pts.
  - ⋆ An increase in new entries raises the share of young firms with more growth potential.
- Ignoring GE effects leads to over- or under-estimating EPL's impact on entrepreneurship and economic growth.

Literature

- **Schumpeterian growth and firm dynamics**: Klette and Kortum (2004), Lentz and Mortensen (2008, 2016), Aghion et al. (2009), Akcigit and Kerr (2018), Acemoglu et al. (2018), Akcigit et al. (2021)
- **Growth by firm age**: Haltiwanger et al. (2013), Deckrt et al. (2014)
- **Entrepreneurship**: Buera et al. (2015), Jones and Pratap (2020), Salgado (2020), Catherine (2022), Gaillard and Kankanamge (2023)
- **Effects of EPL**: Hopenhayn and Rogerson (1993), Koeniger (2005), Autor et al. (2007), Bozkaya and Kerr (2014), Haltiwanger et al. (2014), Mukoyama and Osotimehin (2019)

Outline of Paper

1. Introduction
2. Model
3. Estimation by Indirect Inference
4. Comparative Statics
5. Conclusion

Model

Outline

- **Firm**: Conducts R&D investment for internal and external innovations to obtain rents as a monopolist.
  - ⋆ Assume firms need to pay "layoff taxes" to dismiss workers.
- **Household**: Accumulates two types of human capital (FSHC and GHC) and has a chance to start a business.
- The layoff rate and the entry rate (as well as wages and firm values) are determined in GE.
- Economic growth is brought by creative destruction (external) and incremental innovation (internal).

Internal and External Innovation

- The intermediate-good firms have single or multiple product lines and produce k_j with quality q_j at each line j.

Internal and External Innovation

- The intermediate-good firms have single or multiple product lines and produce k_j with quality q_j at each line j.

- **Internal R&D**: When firms spend for internal innovation,

$$C_I(\tilde{z}_j, q_j) = \tilde{\xi} \tilde{z}_j^{\tilde{\eta}} q_j$$

then, with prob $\tilde{z}_j$, (1) q_j grows at $\tilde{\gamma}$, and (2) line j is NOT vulnerable to creative destruction (= improving line).

Internal and External Innovation

- The intermediate-good firms have single or multiple product lines and produce k_j with quality q_j at each line j.

- **Internal R&D**: When firms spend for internal innovation,

$$C_I(\tilde{z}_j, q_j) = \tilde{\xi}\tilde{z}_j^{\tilde{\eta}} q_j$$

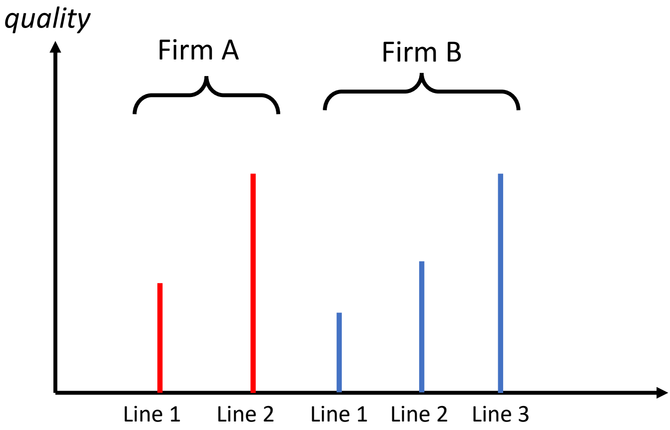
  then, with prob $\tilde{z}_j$, (1) q_j grows at $\tilde{\gamma}$, and (2) line j is NOT vulnerable to creative destruction (= improving line).

- **External R&D**: When firms spend for external innovation,

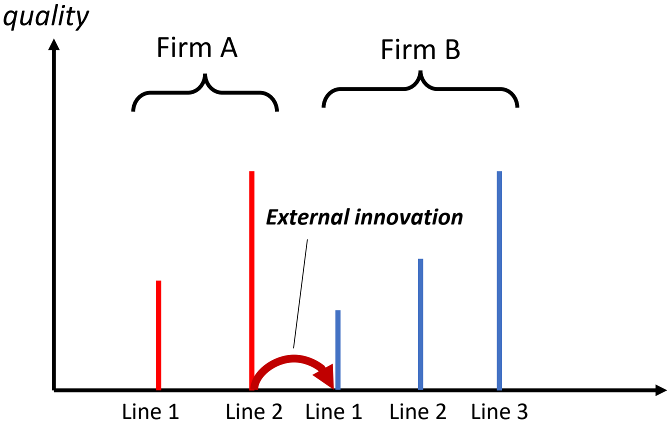
$$C_E(\hat{z}, n) = \left[\hat{\xi}\hat{z}^{\hat{\eta}} + \Phi\right] n\bar{q},$$

  they acquire a new line of the quality $q_j + \hat{\gamma}\bar{q}$ with prob. $(1 - \tilde{x})\hat{z}$ where $\tilde{x}$ is the share of improving lines.

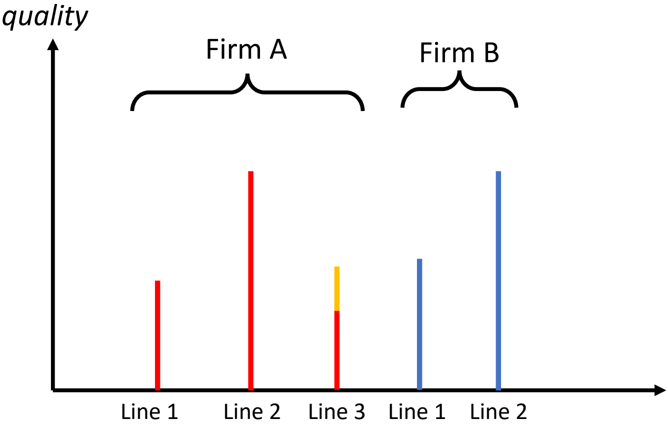
Innovation and Dynamics



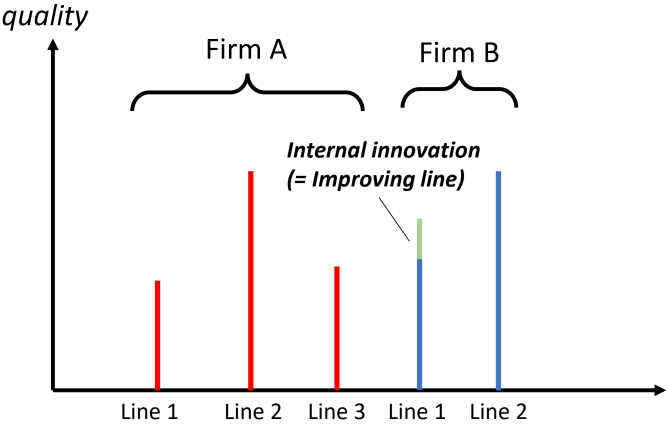
Innovation and Dynamics



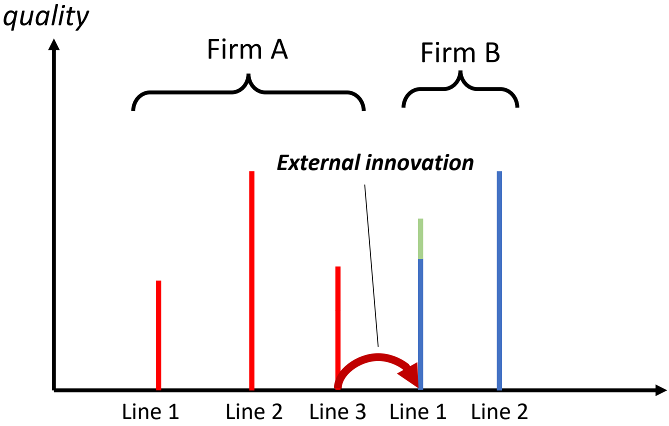
Innovation and Dynamics

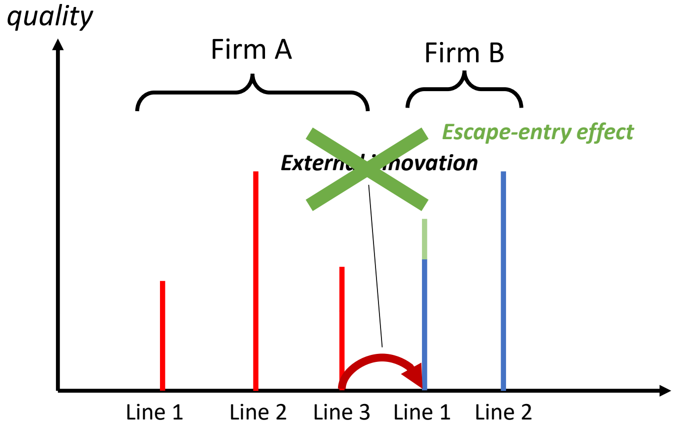


Innovation and Dynamics



Innovation and Dynamics




quality
Firm A
Firm B
Escape-entry effect
External innovation
Line 1
Line 2
Line 3
Line 1
Line 2

Employment Protection and Labor Cost

- A wage rate is w, and the layoff tax is ϕw.

Employment Protection and Labor Cost

- A wage rate is w, and the layoff tax is ϕw.
- In the model, there are two cases to dismiss workers.

Employment Protection and Labor Cost

- A wage rate is w, and the layoff tax is ϕw.
- In the model, there are two cases to dismiss workers.

1. **Product line j is closed**. Let τ denote the rate of creative destruction; The expected layoff tax is $(1 - \tilde{z}_j)\tau\phi w$.

Employment Protection and Labor Cost

- A wage rate is w, and the layoff tax is ϕw.
- In the model, there are two cases to dismiss workers.

1. **Product line j is closed**. Let τ denote the rate of creative destruction; The expected layoff tax is $(1 - \tilde{z}_j)\tau\phi w$.
2. ψ% **jobs are exogenously destructed**. Then,
   - Firms dismiss them or pay the training cost, χw, for re-skilling.
   - When re-skilling s workers and dismissing $1 - s$, the cost is

$$\left[\int_0^s \chi s \; ds + \phi(1 - s)\right] w \times \psi l_j$$

   - Optimal $s^* = \phi/\chi$ and the cost is $\phi(1 - \phi/(2\chi))w \times \psi l_j$

(Static) Profit Maximization

- In sum, the labor cost per worker is $\omega_j w$, where

$$\omega_j \equiv 1 + \underbrace{(1-\tilde{z}_j)\tau\phi}_{Creative\ destruction} + \underbrace{[1-(1-\tilde{z}_j)\tau]\,\phi\,(1-\phi/(2\chi))\,\psi}_{Exogenous\ job\ destruction}$$

where

$$\frac{\partial \omega_j}{\partial \phi} > 0,\ \frac{\partial \omega_j}{\partial \chi} > 0,\ \frac{\partial \omega_j}{\partial \tau} > 0,\ \frac{\partial \omega_j}{\partial \tilde{z}_j} < 0,\ \frac{\partial^2 \omega_j}{\partial \tau \partial \tilde{z}_j} < 0$$

- Note that $\omega_j = 1$ when $\phi = 0$.

(Static) Profit Maximization

- In sum, the labor cost per worker is $\omega_j w$, where

$$\omega_j \equiv 1 + \underbrace{(1-\tilde{z}_j)\tau\phi}_{Creative\ \ destruction} + \underbrace{\left[1-(1-\tilde{z}_j)\tau\right]\phi\left(1-\phi/(2\chi)\right)\psi}_{Exogenous\ \ job\ \ destruction}$$

where

$$\frac{\partial\omega_j}{\partial\phi} > 0,\ \frac{\partial\omega_j}{\partial\chi} > 0,\ \frac{\partial\omega_j}{\partial\tau} > 0,\ \frac{\partial\omega_j}{\partial\tilde{z}_j} < 0,\ \frac{\partial^2\omega_j}{\partial\tau\partial\tilde{z}_j} < 0$$

- Note that $\omega_j = 1$ when $\phi = 0$.
- Final good firms: $Y = \frac{1}{1-\rho}\int_0^1 q_j^{\rho} k_j^{1-\rho} dj$

(Static) Profit Maximization

- In sum, the labor cost per worker is $\omega_j w$, where

$$\omega_j \equiv 1 + \underbrace{(1-\tilde{z}_j)\tau\phi}_{Creative\ destruction} + \underbrace{[1-(1-\tilde{z}_j)\tau]\,\phi\,(1-\phi/(2\chi))\,\psi}_{Exogenous\ job\ destruction}$$

where

$$\frac{\partial \omega_j}{\partial \phi} > 0,\ \frac{\partial \omega_j}{\partial \chi} > 0,\ \frac{\partial \omega_j}{\partial \tau} > 0,\ \frac{\partial \omega_j}{\partial \tilde{z}_j} < 0,\ \frac{\partial^2 \omega_j}{\partial \tau \partial \tilde{z}_j} < 0$$

- Note that $\omega_j = 1$ when $\phi = 0$.
- Final good firms: $Y = \frac{1}{1-\rho}\int_0^1 q_j^{\rho} k_j^{1-\rho} dj$
- Solve $\max_{k_j} \{p_j k_j - \omega_j w l_j\}$, s.t. $k_j = \bar{q} l_j$ where $\bar{q} \equiv \int_0^1 q_j dj$.

State Variables

- Firms are **growing** or **non-growing** firms. Only growing firms can acquire a new product line through external innovation.
- Assume that: (i) all entrants are growing firms, and (ii) they gradually become non-growing ones at the rate of ν.

State Variables

- Firms are **growing** or **non-growing** firms. Only growing firms can acquire a new product line through external innovation.
- Assume that: (i) all entrants are growing firms, and (ii) they gradually become non-growing ones at the rate of ν.
- The set of quality of product lines: $\mathbf{q} \equiv \{q_1, \cdots, q_n\}$.
- Let $\tilde{\mathbf{q}}$ be the set of quality of improving lines. Then, the prob. to realize $\tilde{\mathbf{q}}$ is $\left[\prod_{q_j \in \tilde{\mathbf{q}}} \tilde{z}_j\right] \cdot \left[\prod_{q_j \in \mathbf{q} \setminus \tilde{\mathbf{q}}} (1 - \tilde{z}_j)\right]$.
- Let $\tilde{\mathbf{q}}' \equiv \mathbf{q} \setminus \tilde{\mathbf{q}} \cup (1 + \tilde{\gamma}) \tilde{\mathbf{q}}$, i.e., w/o any events, $\mathbf{q}$ becomes $\tilde{\mathbf{q}}'$.

Value Function

- Let $V_g(\mathbf{q})$ and $V_n(\mathbf{q})$ be the value function for a growing firm and a non-growing firm.
- A growing firm chooses $\tilde{z}_j$ and $\hat{z}$ so as to maximize

$$rV_g(\mathbf{q}) = \max_{\hat{z},\{\tilde{z}_j\}_j} \left\{ \begin{array}{l} \sum_{\tilde{\mathbf{q}} \in 2^{\mathbf{q}}} \left(\prod_{q_j \in \tilde{\mathbf{q}}} \tilde{z}_j \right) \cdot \left(\prod_{q_j \in \mathbf{q} \setminus \tilde{\mathbf{q}}} (1 - \tilde{z}_j) \right) \\ \times \left[\begin{array}{l} V_g\left(\tilde{\mathbf{q}}'\right) - V_g(\mathbf{q}) + \sum_{q_j \in \mathbf{q} \setminus \tilde{\mathbf{q}}} \tau \left\{ V_g(\tilde{\mathbf{q}}' \setminus q_j) - V_g(\tilde{\mathbf{q}}') \right\} \\ + (1 - \tilde{x}) n \hat{z} \left\{ \mathbb{E}_{q_k} V_g\left(\tilde{\mathbf{q}}' \cup (q_k + \hat{\gamma} \bar{q})\right) - V_g(\tilde{\mathbf{q}}') \right\} \\ + \nu \left\{ V_n(\tilde{\mathbf{q}}') - V_g(\tilde{\mathbf{q}}') \right\} \end{array} \right] \\ \\ + \sum_{q_j \in \mathbf{q}} \left[\pi_j q_j - \tilde{\xi} \tilde{z}_j^{\tilde{\eta}} q_j \right] - \left[\hat{\xi} \hat{z}^{\hat{\eta}} + \Phi \right] n \bar{q} \end{array} \right\}.$$

Value Function

- Similarly, a non-growing firm chooses $\tilde{z}_j$ so as to maximize

$$rV_n(\mathbf{q}) = \max_{\{\tilde{z}_j\}_j} \left\{ \begin{array}{l} \sum_{\tilde{\mathbf{q}} \in 2^{\mathbf{q}}} \left(\prod_{q_j \in \tilde{\mathbf{q}}} \tilde{z}_j \right) \cdot \left(\prod_{q_j \in \mathbf{q} \backslash \tilde{\mathbf{q}}} (1 - \tilde{z}_j) \right) \\ \times \left[V_n\left(\tilde{\mathbf{q}}'\right) - V_n(\mathbf{q}) + \sum_{q_j \in \mathbf{q} \backslash \tilde{\mathbf{q}}} \tau \left\{ V_n(\tilde{\mathbf{q}}' \backslash q_j) - V_n(\tilde{\mathbf{q}}') \right\} \right] \\ + \sum_{q_j \in \mathbf{q}} \left[\pi_j q_j - \tilde{\xi} \tilde{z}_j{}^{\tilde{\eta}} q_j \right] \end{array} \right\}.$$

- Since the non-growing firm has no opportunity for external innovation, it chooses only $\tilde{z}_j$.

Firm Sector Equilibrium

Proposition

Let the optimal external innovation intensity for growing firms denote $\hat{z}$. Assume that the fixed cost for external innovation Φ satisfies

$$\Phi = \hat{\xi}(\hat{\eta} - 1)\hat{z}^{\hat{\eta}}.$$

Under this assumption, the optimal internal innovation, $\tilde{z}_j$ is independent of q_j, i.e., $\tilde{z}_j = \tilde{z}$ for all j, and $\hat{z}$, $\tilde{z}$ and the constant value of A for the value function $V_g(\mathbf{q}) = V_n(\mathbf{q}) = V(\mathbf{q}) = A\sum_{q_j \in \mathbf{q}} q_j$ are characterized by:

$$\tilde{\xi}\tilde{\eta}\tilde{z}^{\tilde{\eta}-1} = \frac{\partial \pi}{\partial \tilde{z}} + (\tilde{\gamma} + \tau)A \qquad \textit{and} \qquad \hat{\xi}\hat{\eta}\hat{z}^{\hat{\eta}-1}\bar{q} = (1 - \tilde{x})v^e$$

and

$$rA = \pi - \tilde{\xi}\tilde{z}^{\tilde{\eta}} + \tilde{z}\tilde{\gamma}A - (1 - \tilde{z})\tau A$$

where $v^e = (1 + \hat{\gamma})A\bar{q}$ is the expected value for acquiring a new product line.

Firm Sector Equilibrium

- In equilibrium, $\tilde{x} = \tilde{z}$ because $\tilde{z}_j = \tilde{z}$ for all j.
- The rate of creative destruction $\tau = F_g \hat{z} + x^e$ where F_g is the share of product lines owned by growing firms.
- In stationary equilibrium, F_g is characterized by $\dot{F}_g = 0$ and

$$\dot{F}_g = (1 - \tilde{x})\hat{z}F_g + (1 - \tilde{x})x^e - (1 - \tilde{x})\tau F_g - \nu F_g$$

- **Firm sector Equilibrium**: Given the mass of entries x^e and the labor supply L, the firm-side equilibrium gives (1) Layoff prob. d, (2) Expected firm value v^e, (3) Wage rate w, and (4) Growth rate, g.

Household

- The household is risk-neutral and ages with prob. λ.

Household

- The household is risk-neutral and ages with prob. λ.
- When the age reaches $\bar{a}$, they are retired and replaced with new individuals.

Household

- The household is risk-neutral and ages with prob. λ.
- When the age reaches $\bar{a}$, they are retired and replaced with new individuals.
- They are fired with prob d, and have an opportunity to be an entrepreneur to obtain entrepreneurial income.

Household

- The household is risk-neutral and ages with prob. λ.
- When the age reaches $\bar{a}$, they are retired and replaced with new individuals.
- They are fired with prob d, and have an opportunity to be an entrepreneur to obtain entrepreneurial income.
- **Two types of human capital**: FSHC h_s and GHC h_g. FSHC is valuable only for the current employer (Becker, 1964).
- The labor supply function, $l_s(h_s, h_g) = \bar{h}(1 + h_s + h_g)$

Human Capital Accumulation

- Employed individuals allocate one unit of time to accumulate FSHC or GHC (Wasmer, 2006).

Human Capital Accumulation

- Employed individuals allocate one unit of time to accumulate FSHC or GHC (Wasmer, 2006).
- When they allocate h for FSHC and $1 - h$ for GHC,

$$h'_s = (1 - \delta_s) h_s + A_s h^\alpha \quad \text{and} \quad h'_g = (1 - \delta_g) h_g + A_g (1 - h)^\alpha$$

where $\alpha < 1$ and $0 \leq \delta_s, \delta_g \leq 1$.

Human Capital Accumulation

- Employed individuals allocate one unit of time to accumulate FSHC or GHC (Wasmer, 2006).
- When they allocate h for FSHC and $1-h$ for GHC,

$$h_s' = (1-\delta_s)h_s + A_s h^{\alpha} \quad \text{and} \quad h_g' = (1-\delta_g)h_g + A_g(1-h)^{\alpha}$$

  where $\alpha < 1$ and $0 \leq \delta_s, \delta_g \leq 1$.
- Assume $A_s > A_g$ and/or $\delta_s < \delta_g$, as h_s is substitutable with h_g but lost when quitting the job.

Optimization 1: Human Capital

- The non-employed does not face optimization problems at this stage and their value function at age a is,

$$H_N(a, y, h_g) = c + \beta \left[(1-\lambda) X_N(a, h_g') + \lambda X_N(a+1, h_g') \right]$$

s.t. $h_g' = (1-\delta_g) h_g$ and $c \leq y$, where y is non-labor income.

Optimization 1: Human Capital

- The non-employed does not face optimization problems at this stage and their value function at age a is,

$$H_N(a, y, h_g) = c + \beta \left[(1-\lambda)X_N(a, h_g') + \lambda X_N(a+1, h_g')\right]$$

s.t. $h_g' = (1-\delta_g)h_g$ and $c \leq y$, where y is non-labor income.

- Employed individuals choose h so as to maximize,

$$H_W(a, y, h_s, h_g) = c + \beta \max_{h_s', h_g'} \left[(1-\lambda)X_W(a, h_s', h_g') + \lambda X_W(a+1, h_s', h_g')\right]$$

s.t. $c \leq w l_s(h_s, h_g) + y$, where w is the wage rate.

Optimization 1: Human Capital

- The non-employed does not face optimization problems at this stage and their value function at age a is,

$$H_N(a, y, h_g) = c + \beta \left[(1-\lambda) X_N(a, h_g') + \lambda X_N(a+1, h_g') \right]$$

s.t. $h_g' = (1-\delta_g) h_g$ and $c \leq y$, where y is non-labor income.

- Employed individuals choose h so as to maximize,

$$H_W(a, y, h_s, h_g) = c + \beta \max_{h_s', h_g'} \left[(1-\lambda) X_W(a, h_s', h_g') + \lambda X_W(a+1, h_s', h_g') \right]$$

s.t. $c \leq w l_s(h_s, h_g) + y$, where w is the wage rate.

- $X_W(\bar{a}, h_s, h_g) = X_N(\bar{a}, h_g) = X_W(0, 0, 0)$ for all h_s and h_g

Optimization 2: Entrepreneurial Choice

- After observing the success probability z of starting businesses, individuals make the discrete entrepreneurial choice.

Optimization 2: Entrepreneurial Choice

- After observing the success probability z of starting businesses, individuals make the discrete entrepreneurial choice.
- The value functions for the employed and the non-employed before the entrepreneurial choice,

$$
\begin{aligned}
X_W(a, h_s, h_g) &= \mathbb{E}_z \max\{J_E(a, h_g, z), J_W(a, h_s, h_g)\} \\
X_N(a, h_g) &= \mathbb{E}_z \max\{J_E(a, h_g, z), J_U(a, h_g)\}
\end{aligned}
$$

- $J_E(a, h_g, z)$, $J_W(a, h_s, h_g)$, and $J_U(a, h_g)$ are value functions for the entrepreneur, the employed, and the unemployed.

Value Function for Entrepreneurs and Workers

- Individuals must pay entry costs, κ, to start businesses. When they succeed, they get an entrepreneurial income, $y = v^e - \kappa$

Value Function for Entrepreneurs and Workers

- Individuals must pay entry costs, κ, to start businesses. When they succeed, they get an entrepreneurial income, $y = v^e - \kappa$
- Value functions for entrepreneurs (E), the unemployed (U), and the employed (W) are formulated as,

$$
\begin{aligned}
J_E(a, h_g, z) &= z \cdot H_W(a, v^e - \kappa, 0, h_g) + (1 - z) \cdot H_N(a, -\kappa, h_g) \\
J_U(a, h_g) &= m \cdot H_W(a, 0, 0, h_g) + (1 - m) \cdot H_N(a, 0, h_g) \\
J_W(a, h_s, h_g) &= d \cdot [m \cdot H_W(a, 0, 0, h_g) + (1 - m) \cdot H_N(a, b, h_g)] \\
&\quad + (1 - d) \cdot H_W(a, 0, h_s, h_g)
\end{aligned}
$$

m: Job finding rate, d: Layoff prob, and b: Unemp benefit.

Household Side Equilibrium and General Equilibrium

- There exists the stationary distribution for the employed and the unemployed, $\mu_w(a, h_s, h_g)$ and $\mu_n(a, h_g)$.

Household Side Equilibrium and General Equilibrium

- There exists the stationary distribution for the employed and the unemployed, $\mu_w(a, h_s, h_g)$ and $\mu_n(a, h_g)$.
- **Household-side equilibrium**: Given r, d, v^e, w, and g, it gives the mass of entries x^e and the aggregate labor supply L.

Household Side Equilibrium and General Equilibrium

- There exists the stationary distribution for the employed and the unemployed, $\mu_w(a, h_s, h_g)$ and $\mu_n(a, h_g)$.
- **Household-side equilibrium**: Given r, d, v^e, w, and g, it gives the mass of entries x^e and the aggregate labor supply L.
- **Competitive equilibrium**: *A tuple $(d^*, v^{e*}, w^*, g^*, x^{e*}, L^*)$ such that: (i) given the mass of entries x^{e*} and the aggregate labor supply L^*, the firm-side equilibrium is consistent with the layoff probability d^*, the expected firm value for entrants v^{e*}, the wage rate w^*, and the growth rate g^*; and (ii) given d^*, v^{e*}, w^*, and g^*, the household-side equilibrium is consistent with x^{e*} and L^*.*

Quantitative Analysis

Calibration for Firm Parameters

- Some parameters are calibrated following previous empirical studies and macro data.

Parameter	Value	Target value etc.
Production function, ρ	0.104	$\omega wL/Y = 0.803$
Innovation elasticity, $\hat{\eta}, \tilde{\eta}$,	2.0	Acemoglu et al. (2018)
Interest rate, r	0.04	Standard value
Aggregate labor supply, L	1.0	Normalization

Calibration for Firm Parameters

- Some parameters are calibrated following previous empirical studies and macro data.

Parameter	Value	Target value etc.
Production function, ρ	0.104	$\omega wL/Y = 0.803$
Innovation elasticity, $\hat{\eta}, \tilde{\eta}$,	2.0	Acemoglu et al. (2018)
Interest rate, r	0.04	Standard value
Aggregate labor supply, L	1.0	Normalization

- The rest of the firm parameters, $x^e, \tilde{\gamma}, \hat{\gamma}, \tilde{\xi}, \hat{\xi}, \psi, \chi, \nu$, and ϕ, are estimated by indirect inference using the loss function,

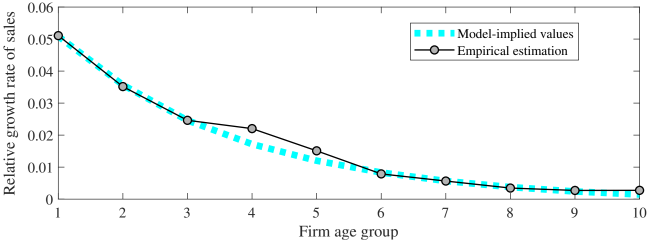
$$\sum_{i=1}^{17} \frac{|\text{model}(i) - \text{data}(i)|}{|\text{data}(i)|}$$

Target Moments

- The model fairly replicates 17 moments used for estimation, including 7 moments below, and...

Moment	With EPL					Without EPL	
	Entry	growth	R&D	Int. R&D	Layoff	Int. R&D	Layoff
Model	4.4	0.7	3.2	61.8	7.2	47.5	12.0
Data	4.4	0.7	3.2	66.0	7.2	48.0	12.0

- ...10 moments for firm growth by firm age.



Estimated Parameters

x^e	$\tilde{\gamma}$	$\hat{\gamma}$	$\tilde{\xi}$	$\hat{\xi}$	ψ	χ	ν	ϕ
.049	.09	11.18	.14	3.57	.040	.477	.033	.318

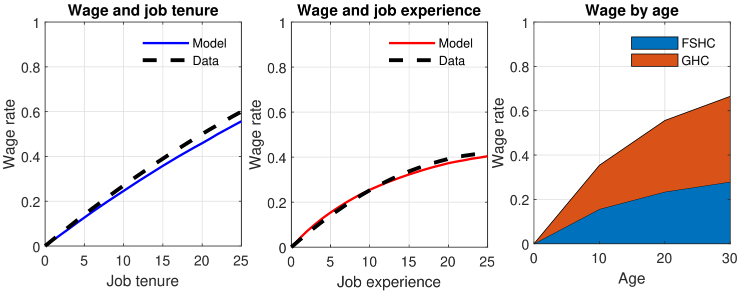
- The cost for external innovation $\hat{\xi}$ is around 25 times larger than that for internal innovation $\tilde{\xi}$.
- Also, the step size for external innovation $\hat{\gamma}$ is estimated to be much larger than internal innovation $\tilde{\gamma}$.
- The share of internal innovation is high, as it induces not only quality improvement but also escape-entry effects.

Calibration for Household Parameters

- Household parameters for human-capital accumulation are calibrated to fit Japanese data.

Calibration for Household Parameters

- Household parameters for human-capital accumulation are calibrated to fit Japanese data.
- The relationship between wages and job experience/tenure is estimated "Japan Household Panel Survey (JHPS/KHPS)"



Calibration for Household Parameters

Parameter	Value	Target value etc.
Discount rate, β	0.96	$\beta = 1/(1+r)$
Stochastic aging, λ	1/10	One unit is 10 years
Retirement age, $\bar{a}$	4	Working for 40 years
Unemployment benefit, b	0.40	40% of current wages
Job-finding rate, m	0.74	Unemployment rate $=$ 3.0%
Curvature for HC inv., α	0.80	Guvenen et al. (2014)
Depreciation for FSHC, δ_s	0.00	Estimation results
Depreciation for GHC, δ_g	0.053	Estimation results
Efficiency: FSHC inv., A_s	0.068	Estimation results
Efficiency: GHC inv., A_g	0.059	Estimation results
Scale parameter for labor, $\bar{l}^s$	0.059	$L = 1.0$ (Firm-side equilibrium)
Entry cost, κ	0.134	Entry rate $x^e = 0.049$ (Firm-side)
Dist. of success prob., σ_z	0.192	The failure rate $=$ 50%
Mass of households, M_h	9.81	Entry cost $= 1.5\times$ Labor income

Comparative Statics: Effects of Employment Protection

- The policy exercise asks: What if the EPL in Japan is eliminated as in the U.S.?

Comparative Statics: Effects of Employment Protection

- The policy exercise asks: What if the EPL in Japan is eliminated as in the U.S.?
- The layoff tax ϕ is set to zero in the hypothetical case to compare with the baseline with $\phi > 0$.

Comparative Statics: Effects of Employment Protection

- The policy exercise asks: What if the EPL in Japan is eliminated as in the U.S.?
- The layoff tax ϕ is set to zero in the hypothetical case to compare with the baseline with $\phi > 0$.
- **Computational strategy**: We repeatedly compute the firm- and household-side equilibrium by taking the other as given. In each iteration, aggregate variables are adjusted gradually.

Result of Comparative Statics

	(1) Layoff	(2) In. R&D	(3) Entry rate	(4) Growth	(5) Firm val.
Baseline ($\phi > 0$)	7.2	61.8	4.4	0.70	1.00
No EPL ($\phi = 0$) in GE	12.0	47.0	6.4	0.96	0.97
No EPL ($\phi = 0$) in PE	11.1	43.5	5.3	0.86	1.10

Result of Comparative Statics

	(1) Layoff	(2) In. R&D	(3) Entry rate	(4) Growth	(5) Firm val.
Baseline ($\phi > 0$)	7.2	61.8	4.4	0.70	1.00
No EPL ($\phi = 0$) in GE	12.0	47.0	6.4	0.96	0.97
No EPL ($\phi = 0$) in PE	11.1	43.5	5.3	0.86	1.10

- As expected, eliminating EPL increases layoff prob. (7.2% $\rightarrow$ 12.0%) because:
  - ⋆ Firms tend to choose layoff rather than re-skilling in the face of exogenous job destruction,
  - ⋆ Firms have less incentive to protect their product lines, thus lowering the internal R&D ratios (Column 2), and
  - ⋆ More firm entries (Column 3) intensify creative destruction.

EPL and Firm Dynamics

- Eliminating EPL stimulates firm dynamics by increasing new entrants (Column 3) because:

EPL and Firm Dynamics

- Eliminating EPL stimulates firm dynamics by increasing new entrants (Column 3) because:
    1. The weaker escape-entry effect (i.e., the lower internal R&D) makes firm entries easier, and

EPL and Firm Dynamics

- Eliminating EPL stimulates firm dynamics by increasing new entrants (Column 3) because:
  1. The weaker escape-entry effect (i.e., the lower internal R&D) makes firm entries easier, and
  2. Entrepreneurship in the household sector becomes more active.

EPL and Firm Dynamics

- Eliminating EPL stimulates firm dynamics by increasing new entrants (Column 3) because:
  1. The weaker escape-entry effect (i.e., the lower internal R&D) makes firm entries easier, and
  2. Entrepreneurship in the household sector becomes more active.
- Comparing GE and PE, the 2nd channel is crucial.
  - ⋆ The entry rate rises from 4.4% to 6.4% in GE but 5.3% in PE.

EPL and Firm Dynamics

- Eliminating EPL stimulates firm dynamics by increasing new entrants (Column 3) because:
  1. The weaker escape-entry effect (i.e., the lower internal R&D) makes firm entries easier, and
  2. Entrepreneurship in the household sector becomes more active.
- Comparing GE and PE, the 2nd channel is crucial.
  - ⋆ The entry rate rises from 4.4% to 6.4% in GE but 5.3% in PE.
- The effects of EPL on human capital accumulation are key to understanding the 2nd channel through GE effects.

EPL and Human Capital

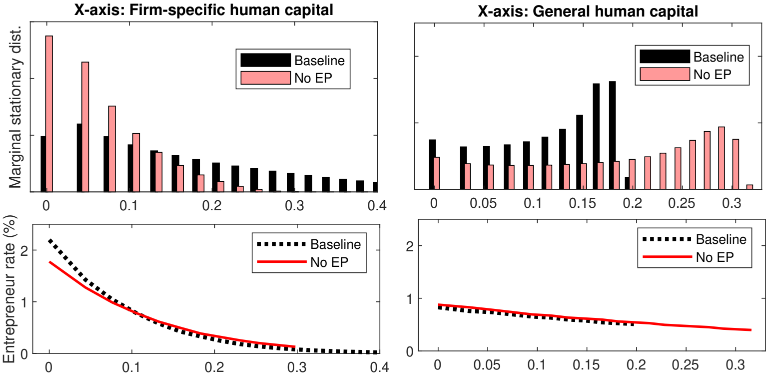
EPL and Human Capital

- Higher layoff prob. encourages a shift from FSHC to GHC.

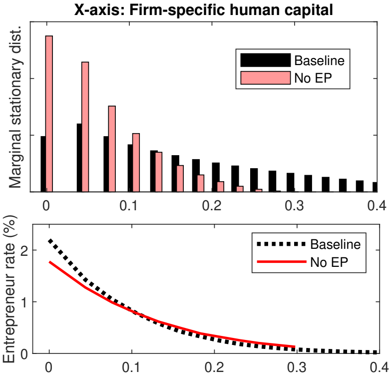
EPL and Human Capital

- Higher layoff prob. encourages a shift from FSHC to GHC.
- Previous empirical works show that FSHC is less important in the U.S., e.g., Kambourov and Manovskii (2008)

Human Capital and Entrepreneurship

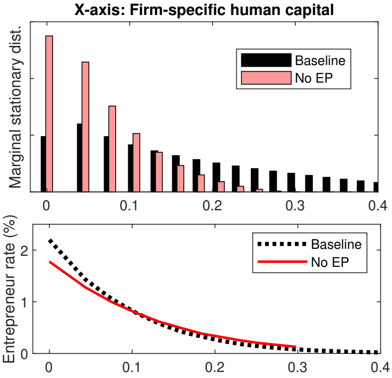


Human Capital and Entrepreneurship



- The stationary distribution shifts from FSHC to GHC.

Human Capital and Entrepreneurship



- The stationary distribution shifts from FSHC to GHC.
- The entrepreneurial policy function is decreasing wrt FSHC and almost identical for the cases w/ and w/o EPL.

Why Does Eliminating EPL Stimulate Entrepreneurship?

Why Does Eliminating EPL Stimulate Entrepreneurship?

- Higher layoff prob. causes the shift from FSHC to GHC, thus decreasing the opportunity cost of starting a business.

Why Does Eliminating EPL Stimulate Entrepreneurship?

- Higher layoff prob. causes the shift from FSHC to GHC, thus decreasing the opportunity cost of starting a business.
- Eliminating EPL stimulates entrepreneurship also by:
  - ⋆ Lowering labor costs and raising the entrepreneurial benefit,
  - ⋆ Making employed workers unstable and thus less attractive.
- Given the almost identical policy function for entrepreneurial decisions, the effects through those channels are not large.

EPL and Economic Growth

- Eliminating EPL raises economic growth by around 20-30 bps.

EPL and Economic Growth

- Eliminating EPL raises economic growth by around 20-30 bps.
- More firm entries stimulate creative destruction by themselves but also by increasing the share of young firms.
  - ⋆ The share of product lines owned by growing firms F_g rises from 64.1% to 71.4% when eliminating EPL.

EPL and Economic Growth

- Eliminating EPL raises economic growth by around 20-30 bps.
- More firm entries stimulate creative destruction by themselves but also by increasing the share of young firms.
  - ⋆ The share of product lines owned by growing firms F_g rises from 64.1% to 71.4% when eliminating EPL.
- **Short run**: EPL's effects on consumption are ambiguous, as eliminating EPL increases w but decreases L.
- **Long run**: Eliminating EPL induces higher wage growth and should have positive *cumulative* effects on consumption.

General Equilibrium Effects: Entrepreneurship

	(1) Layoff	(2) In. R&D	(3) Entry rate	(4) Growth	(5) Firm val.
Baseline ($\phi > 0$)	7.2	61.8	4.4	0.70	1.00
No EPL ($\phi = 0$) in GE	12.0	47.0	6.4	0.96	0.97
No EPL ($\phi = 0$) in PE	11.1	43.5	5.3	0.86	1.10

- PE ignores changes in entrepreneurship and labor supply on the household side (i.e., GE effects).

General Equilibrium Effects: Entrepreneurship

	(1) Layoff	(2) In. R&D	(3) Entry rate	(4) Growth	(5) Firm val.
Baseline ($\phi > 0$)	7.2	61.8	4.4	0.70	1.00
No EPL ($\phi = 0$) in GE	12.0	47.0	6.4	0.96	0.97
No EPL ($\phi = 0$) in PE	11.1	43.5	5.3	0.86	1.10

- PE ignores changes in entrepreneurship and labor supply on the household side (i.e., GE effects).
- In PE, the increase in the entry rate and economic growth are only around $1/2$ and $2/3$, respectively.

General Equilibrium Effects: Entrepreneurship

	(1) Layoff	(2) In. R&D	(3) Entry rate	(4) Growth	(5) Firm val.
Baseline ($\phi > 0$)	7.2	61.8	4.4	0.70	1.00
No EPL ($\phi = 0$) in GE	12.0	47.0	6.4	0.96	0.97
No EPL ($\phi = 0$) in PE	11.1	43.5	5.3	0.86	1.10

- PE ignores changes in entrepreneurship and labor supply on the household side (i.e., GE effects).
- In PE, the increase in the entry rate and economic growth are only around $1/2$ and $2/3$, respectively.
- Layoff prob. is low in PE, which implies that layoffs and new entries increase by influencing each other in GE.

General Equilibrium Effects: Firm Value

	(1) Layoff	(2) In. R&D	(3) Entry rate	(4) Growth	(5) Firm val.
Baseline ($\phi > 0$)	7.2	61.8	4.4	0.70	1.00
No EPL ($\phi = 0$) in GE	12.0	47.0	6.4	0.96	0.97
No EPL ($\phi = 0$) in PE	11.1	43.5	5.3	0.86	1.10

- In GE, eliminating EPL *lowers* the average firm value due to intensified creative destruction.

General Equilibrium Effects: Firm Value

	(1) Layoff	(2) In. R&D	(3) Entry rate	(4) Growth	(5) Firm val.
Baseline ($\phi > 0$)	7.2	61.8	4.4	0.70	1.00
No EPL ($\phi = 0$) in GE	12.0	47.0	6.4	0.96	0.97
No EPL ($\phi = 0$) in PE	11.1	43.5	5.3	0.86	1.10

- In GE, eliminating EPL *lowers* the average firm value due to intensified creative destruction.
- The decrease in firm value in GE subdues entrepreneurship.

General Equilibrium Effects: Firm Value

	(1) Layoff	(2) In. R&D	(3) Entry rate	(4) Growth	(5) Firm val.
Baseline ($\phi > 0$)	7.2	61.8	4.4	0.70	1.00
No EPL ($\phi = 0$) in GE	12.0	47.0	6.4	0.96	0.97
No EPL ($\phi = 0$) in PE	11.1	43.5	5.3	0.86	1.10

- In GE, eliminating EPL *lowers* the average firm value due to intensified creative destruction.
- The decrease in firm value in GE subdues entrepreneurship.
- Without $v_e \downarrow$, i.e., in the household sector PE, the increase in entrepreneurs is overestimated by more than double.

Policy Experiments

How can we stimulate economic growth without easing EPL?

- Since eliminating ELP is politically difficult, the two policies to stimulate entrepreneurship are examined.

Policy Experiments

How can we stimulate economic growth without easing EPL?

- Since eliminating ELP is politically difficult, the two policies to stimulate entrepreneurship are examined.

1. Unemployment benefits to failed entrepreneurs
   - ⋆ They increase new entries in France (Hombert et al. 2020).
   - ⋆ Japan introduced a similar policy in 2022.
   - ⋆ Value function when failed: $H_N(-\kappa, h_g) \to H_N(b - \kappa, h_g)$

Policy Experiments

How can we stimulate economic growth without easing EPL?

- Since eliminating ELP is politically difficult, the two policies to stimulate entrepreneurship are examined.

1. Unemployment benefits to failed entrepreneurs
    - ⋆ They increase new entries in France (Hombert et al. 2020).
    - ⋆ Japan introduced a similar policy in 2022.
    - ⋆ Value function when failed: $H_N(-\kappa, h_g) \to H_N(b - \kappa, h_g)$
2. Entrepreneurial leave
    - ⋆ A leave with the option to return to the previous job increases entrepreneurs in Canada (Gottlieb et al. 2022)
    - ⋆ Value function when failed: $H_W\left(-wl_s(h_s, h_g), h_s, h_g\right)$

Results of Policy Experiments

	Entrepreneur	In. R&D	Entry rate	Firm value	Growth
Baseline	1.00	61.8	4.40	1.00	0.70
Unemp. benefit	1.11	64.1	4.64	0.96	0.72
Entre. leave	1.33	68.4	5.11	0.88	0.76

Results of Policy Experiments

	Entrepreneur	In. R&D	Entry rate	Firm value	Growth
Baseline	1.00	61.8	4.40	1.00	0.70
Unemp. benefit	1.11	64.1	4.64	0.96	0.72
Entre. leave	1.33	68.4	5.11	0.88	0.76

- The policy supports increase entrepreneurs (Column 1).
  - ⋆ Without the decrease in firm value in GE, the policy effects should be overestimated.

Results of Policy Experiments

	Entrepreneur	In. R&D	Entry rate	Firm value	Growth
Baseline	1.00	61.8	4.40	1.00	0.70
Unemp. benefit	1.11	64.1	4.64	0.96	0.72
Entre. leave	1.33	68.4	5.11	0.88	0.76

- The policy supports increase entrepreneurs (Column 1).
  - ⋆ Without the decrease in firm value in GE, the policy effects should be overestimated.
- The effects on economic growth are a few bps (Column 5).
  - ⋆ With EPL, the increase in new entrants encourages incumbent firms to pursue the escape-entry effects.

Conclusion

- This paper analyzes the effects of EPL on entrepreneurship and economic growth in a Schumpeterian growth model.

Conclusion

- This paper analyzes the effects of EPL on entrepreneurship and economic growth in a Schumpeterian growth model.
- The quantitative exercise using Japanese data finds that:
    1. Eliminating EPL in Japan raises growth by around 20-30bps.
    2. PE focusing only on the household or the firm sector under- or overestimate the effects of EPL,
    3. ELP subdues the effects of policy support for entrepreneurs.

Conclusion

- This paper analyzes the effects of EPL on entrepreneurship and economic growth in a Schumpeterian growth model.
- The quantitative exercise using Japanese data finds that:
  1. Eliminating EPL in Japan raises growth by around 20-30bps.
  2. PE focusing only on the household or the firm sector under- or overestimate the effects of EPL,
  3. ELP subdues the effects of policy support for entrepreneurs.
- A cost-benefit analysis to discuss the optimal level of EPL is one of the next steps.

Additional Slides

R&D Investment and Growth by Firm Age

- **Two types of R&D investment**: (1) creative destruction, and (2) incremental innovation on existing products to survive.
- Quantile regression on growth and R&D investment:

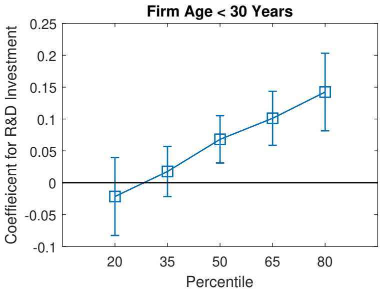
$$\Delta \text{Sale}_{i,t} = \alpha_Q + \beta_Q \text{R\&D}_{i,t-1} + \varepsilon_{i,t}$$

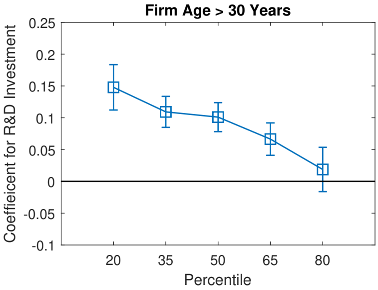
$\text{R\&D}_{i,t-1}$ = 3-year average of R&D investment to asset ratio

- β_Q is the effect of R&D investment on Q-percentile of sales.
- **Idea**: R&D investments of type 1 and 2 are expected to raise upper and lower percentiles, respectively.

R&D Investment and Growth by Firm Age

Go Back





- Young (old) firms' R&D investment has positive effects only on the upper (lower) percentiles of sales growth.
- Young firms invest to grow, while old firms invest to survive.

Employment protection, Entrepreneurship, and Job Tenure

	Entrepreneur rate			Job Tenure	
	(1)	(2)	(3)	(4)	(5)
EPL index	-2.60*	-3.08**	-3.27**	.067**	.073**
	(1.11)	(0.97)	(0.73)	(.017)	(.017)
log(GDP)		-2.81**			.026
		(0.65)			(.016)
Sample	Full	Full	GDP$>$ \$20K	Full	Full
N	65	64	25	36	36

- EPL suppresses entrepreneurship while extending job tenure and encouraging human capital accumulation. Go Back