Employment Protection, Investment in Job-Specific Skills, and Inequality Trends in the United States and Europe

Matthias Doepke and Ruben Gaetani
Explaining Trends in College Wage Premium

The question:

- Large rise in college wage premium since 1980s in the United States, but not in continental Europe.
- What explains the difference?

Our conjecture:

Differences in labor market regulation are (in part) responsible. FIRING RESTRICTIONS AFFECT INCENTIVE TO INVEST IN RELATIONSHIP-SPECIFIC CAPITAL.

Restrictions for firing older workers particularly relevant, which is where US-Europe differences are the largest.
Explaining Trends in College Wage Premium

The question:
- Large rise in college wage premium since 1980s in the United States, but not in continental Europe.
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Our conjecture:
- Differences in labor market regulation are (in part) responsible.
- Firing restrictions affect incentive to invest in relationship-specific capital.
- Restrictions for firing older workers particularly relevant, which is where US-Europe differences are the largest.
Employment Protection and Change in College Wage Premium

OECD index of employment protection versus change in college premium, 1980–2006:
Overview of Mechanism

- Focus on workers’ decisions on investment in skills and firms’ decisions to create jobs that allow for accumulation of skills.

- Model features:
  - Jobs that may or may not allow for skill accumulation.
  - Workers decide on investment in skills.
  - Worker-firm matches subject to productivity shocks.
  - Skills of college-educated workers are transferable.
  - Skills of less-educated workers are job specific.
Overview of Mechanism

- Labor market regulation interacts with changes in "turbulence."
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- **Low turbulence:**
  - Low probability of separation even without firing restrictions.
  - Many skilled jobs, most workers invest in skills regardless of regulation.

- **High turbulence:**
  - No firing restrictions (U.S.): Few skilled vacancies for less-educated workers; only educated workers invest in skills; high wage premium.
  - Firing restrictions (Europe): More skilled vacancies; most workers continue to invest; low wage premia.
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    - Firing restrictions (Europe): More skilled vacancies; most workers continue to invest; low wage premia.
United States
Germany
Related Literature

1. Vast literature on changes in inequality, skill-biased technical change, capital-skill complementarity . . . .

2. Some closely related work:
   - Acquisition of skills on the job and changes in inequality: Guvenen, Kuruscu, and Ozcan (2014).
   - Labor protection and investment in skills: Delacroix and Wasmer (2007).
1. Facts on employment protection, college premium, and worker tenure, US versus Germany.

2. Model of investment in job-specific skills.

3. Effect of rise in turbulence on college premium.

4. Role of employment protection.
1. Facts
Labor Market Regulation

- European labor markets more regulated.
- In many cases, explicit or implicit age discrimination:
  - Distinction between regular and temporary contracts.
  - Features like “Sozialauswahl” in Germany for layoffs.
- Protection for older/experienced workers particularly relevant for mechanism.
OECD Index of Employment Protection for Regular Employees
OECD Index of Employment Protection for Temporary Employees

France
Germany
Italy
United States
College Premium, US versus Germany

The graph compares the college premium in the US and Germany from 1985 to 2010. The US line (blue) shows a generally upward trend, with significant increases around 1995 and 2000. The Germany line (yellow) fluctuates more, with periods of stability and increases, particularly noticeable around 2005 and 2010.
Share of College Graduates (25–64), US versus Germany
Worker Tenure, US versus Germany

Fraction of college-educated workers 45–55 with 20+ years of tenure (PSID/SOEP)
Worker Tenure, US versus Germany

Fraction of less-educated workers 45–55 with 20+ years of tenure (PSID/SOEP)
## Education and Transferability of Skills

### Log of hourly wage, age 45-54

**USA (PSID)**

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Tenure &gt;= 20, High-school</strong></td>
<td>.235***</td>
<td>.236***</td>
</tr>
<tr>
<td></td>
<td>(.045)</td>
<td>(.033)</td>
</tr>
<tr>
<td><strong>Tenure &gt;= 20, College</strong></td>
<td>.129***</td>
<td>.156***</td>
</tr>
<tr>
<td></td>
<td>(.061)</td>
<td>(.044)</td>
</tr>
<tr>
<td>Exper. 3rd degree pol.</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td><strong># Obs.</strong></td>
<td>1,875</td>
<td>1,278</td>
</tr>
<tr>
<td><strong>$R^2$</strong></td>
<td>0.10</td>
<td>0.04</td>
</tr>
</tbody>
</table>
## Education and Transferability of Skills

<table>
<thead>
<tr>
<th></th>
<th>Log of hourly wage, age 45-54</th>
<th>Germany (SOEP)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1984-1995</td>
<td>1996-2013</td>
</tr>
<tr>
<td>Tenure &gt;= 20, High-school</td>
<td>.098*** (.021)</td>
<td>.143*** (.022)</td>
</tr>
<tr>
<td>Tenure &gt;= 20, College</td>
<td>-.035 (.051)</td>
<td>-.075* (.041)</td>
</tr>
<tr>
<td>Exper. 3rd degree pol.</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td># Obs.</td>
<td>4,008</td>
<td>1,066</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.11</td>
<td>0.13</td>
</tr>
</tbody>
</table>
2. Model
A Model of the Impact of Labor Market Turbulence on Skill Acquisition

- Life cycle model, ages 25 to 64.
- Two education types $s \in \{H, L\}$:
  - $H$ acquire (mostly) general skills.
  - $L$ acquire (mostly) job-specific skills.
- Two types of jobs:
  - All jobs for educated workers allow accumulation of skill.
  - For less-educated workers, only fraction $v_A$ of jobs does.
Investment in Relationship-Specific Capital

- Young workers $s \in \{H, L\}$ draw initial productivity $h \in \{h_1, \ldots, h_n\}$ from $F^s(h)$.

- If on job allows for skill accumulation, can exert costly effort $e$ at cost to upgrade skill with probability $p(e)$.

- Potential for skill loss after separation.
Labor Market

- Separate labor markets by education; matching function in market $s \in \{H, L\}$ is $m^s(u^s, v^s)$.
- Vacancy posting cost $k^s$.
- In $L$ market, firms also draw heterogeneous cost $k_A$ for posting accumulation-type vacancy.
- Firm opens accumulation-type vacancy if:
  \[ k_A \leq E \left[ J_A^L \right] - E \left[ J_N^L \right] \]
- Wages determined via Nash bargaining with downward wage rigidity: wage cannot fall below fraction $\delta < 1$ of “prevailing wage” for worker with education $s$ and skill $h$. 
Impose fixed job finding rate $\lambda^s$ (implicitly, through choosing parameters of matching function).

Uniform distribution for cost $k_A$, so that fraction of accumulation-type vacancies is given by:

$$v_A^L = \min \left\{ \max \left\{ \frac{E \left[ J_A^L \right] - E \left[ J_N^L \right]}{(c_1 - c_0)E \left[ J_N^L \right]} - \frac{c_0}{c_1 - c_0}, 0 \right\}, 1 \right\}.$$
Turbulence and Skill Loss

- Match output in regular times:

\[ y^s(h, x) = a^s(x) h. \]

- With probability \( \gamma^s \), turbulence shock reduces productivity by factor \( \epsilon \sim \text{Uniform}(0, \bar{\epsilon}) \).

- Productivity returns to normal with probability \( \epsilon \).

- Separation if continuation value of firm is lower than firing cost \( f^s \).

- Skill loss upon separation: For \( j < i \), transition probability \( Q^s(i, j) \) defined by:

\[
Q^s(i, j) = \sigma^s Q^s(i, j + 1), \quad \sum_{j=1}^{i} Q^s(i, j) = 1.
\]

- Set \( \sigma^H < \sigma^L \): skill loss more severe for less-educated workers.
Bellman Equations for Employed Workers

\[ V_N^s(x, h) = w_N^s(x, h) + \beta \left[ (1 - \gamma^s) V_N^s(x + 1, h) + \gamma^s E \left( \tilde{V}_N^s(x + 1, h', \epsilon) \right) \right] \]

\[ V_A^s(x, h) = \max_{\epsilon} \left\{ w_A^s(x, h) - a^s(x) h\epsilon^2 \right. \]
\[ + \beta \left[ (1 - \gamma^s) E \left( V_A^s(x + 1, h') \right) + \gamma^s E \left( \tilde{V}_A^s(x + 1, h', \epsilon) \right) \right] \]
Bellman Equation for Firm Experiencing Turbulence

\[ \tilde{J}_p^s(x, h, \epsilon) = \max \left\{ a^s(x)h\epsilon - \delta w_p^s(x, h) + \beta \left[ \gamma^s E \left( \tilde{J}_p^s(x + 1, h, \epsilon') \right) + (1 - \gamma^s)(1 - \pi^s)\tilde{J}_p^s(x + 1, h, \epsilon) + (1 - \gamma^s)\pi^s J_p^s(x + 1, h) \right], -f^s \right\} \]
Bellman Equation for Unemployed Worker

\[ U^s(x, h) = a^s(x)h \bar{b} + \beta \left\{ \lambda^s [v^s_A V^s_A(x + 1, h) + (1 - v^s_A) V^s_N(x + 1, h)] + (1 - \lambda^s) U^s(x+1, h) \right\} \]
3. Quantitative Evaluation
Calibration Exercise for the United States

- Parameterize model to match college premium, tenure premium, and share of high-tenure workers in 1980.
- Choose change in overall skill bias and turbulence shock to match college premium, tenure premium, and share of high-tenure workers in 2010.
- Examine role of investment in relationship-specific capital for the impact of these change on college wage premium in 2010.
## Preset Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount rate</td>
<td>$\beta$</td>
<td>0.95</td>
</tr>
<tr>
<td>Yearly $r$</td>
<td>5.25%</td>
<td></td>
</tr>
<tr>
<td>Job finding rate</td>
<td>$\lambda$</td>
<td>0.8</td>
</tr>
<tr>
<td>Av. unempl. spell 3 mo.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bargaining weight</td>
<td>$\alpha$</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gertler and Trigari (2009)</td>
</tr>
<tr>
<td>Non-market prod.</td>
<td>$b$</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.5 $\times$ 40% replacement rate</td>
</tr>
<tr>
<td>Wage rigidity</td>
<td>$\delta$</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20% wage cut</td>
</tr>
<tr>
<td>Param.</td>
<td>Value</td>
<td>Moment</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>$L$ skill specificity</td>
<td>$\sigma^L$</td>
<td>$0.44$</td>
</tr>
<tr>
<td>$H$ skill specificity</td>
<td>$\sigma^H$</td>
<td>$0.15$</td>
</tr>
<tr>
<td>Prob. skill upgrade</td>
<td>$\bar{\varepsilon}$</td>
<td>$0.34$</td>
</tr>
<tr>
<td>Skill-biased tech.</td>
<td>$A^H_{80}$</td>
<td>$1.12$</td>
</tr>
<tr>
<td>$L$ turbulence</td>
<td>$\gamma^L_{80}$</td>
<td>$0.095$</td>
</tr>
<tr>
<td>$H$ turbulence</td>
<td>$\gamma^H_{80}$</td>
<td>$0.079$</td>
</tr>
<tr>
<td>Pareto initial skills</td>
<td>$\eta$</td>
<td>$1.67$</td>
</tr>
<tr>
<td>Productivity loss</td>
<td>$\bar{\epsilon}$</td>
<td>$0.6$</td>
</tr>
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</table>
## 2010 US Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Moment</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>( L ) turbulence</td>
<td>( \gamma_L^{10} )</td>
<td>0.128</td>
<td>( L ) long tenure, 2010</td>
<td>0.23</td>
</tr>
<tr>
<td>( H ) turbulence</td>
<td>( \gamma_H^{10} )</td>
<td>0.115</td>
<td>( H ) long tenure, 2010</td>
<td>0.25</td>
</tr>
<tr>
<td>Fraction of A jobs</td>
<td>( \nu_{A,10}^L )</td>
<td>0.63</td>
<td>( L ) Exp. premium</td>
<td>-0.02</td>
</tr>
<tr>
<td>SBTC</td>
<td>( A_{10}^H )</td>
<td>1.24</td>
<td>2010 College premium</td>
<td>0.48</td>
</tr>
<tr>
<td>Return to exp.</td>
<td>( g_{10} )</td>
<td>0.005</td>
<td>( H ) Exp. premium</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Investment in Skill Upgrading

The graph illustrates the probability of skill upgrades for non-college and college graduates over different years, as a function of experience. The data shows a decrease in the probability of skill upgrades with increasing experience for both groups, with college graduates generally having a lower probability of skill upgrades than non-college graduates for the same level of experience.

- **Non-college, 1980**
- **College, 1980**
- **Non-college, 2010**
- **College, 2010**

The curves indicate that the probability of skill upgrading decreases as experience increases, with college graduates having a lower probability of skill upgrading compared to non-college graduates.
Investment in Skill Upgrading: Impact of Turbulence

![Graph showing the probability of skill upgrade against experience for non-college and college workers in 1980 and 2010.]

- Non-college, 1980
- College, 1980
- Non-college, 2010
- College, 2010
Skill Distribution

The graph shows the distribution of skills over different skill levels for non-college and college graduates in 1980 and 2010. The x-axis represents skill level, while the y-axis represents the cumulative distribution function (CDF) of skills. The lines indicate the proportion of the population with skills up to a certain level.

- Blue line: Non-college, 1980
- Blue dashed line: Non-college, 2010
- Red line: College, 1980
- Red dashed line: College, 2010
## Impact of Turbulence on College Premium

<table>
<thead>
<tr>
<th>Setting</th>
<th>College Premium</th>
</tr>
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<tbody>
<tr>
<td>1980 data/model</td>
<td>0.287</td>
</tr>
<tr>
<td>2010 data/model with turbulence, SBTC</td>
<td>0.485</td>
</tr>
<tr>
<td>2010 model with turbulence</td>
<td>0.378</td>
</tr>
<tr>
<td>2010 model with turbulence (fixed job composition)</td>
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</tr>
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Turbulence accounts for 46 percent of the rise in college premium. Primarily because fewer jobs allow for skill accumulation.
Impact of Turbulence on College Premium

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→ Turbulence accounts for 46 percent of rise in college premium.
→ Primarily because fewer jobs allow for skill accumulation.
Cohort Effects in the Model

- **1980**
  - 25-39: 0.5
  - 40-54: 1
  - College premium relative to 1980

- **1990**
  - 25-39: 1
  - 40-54: 1.5

- **2000**
  - 25-39: 0.5
  - 40-54: 1

- **2010**
  - 25-39: 0
  - 40-54: 0.5
Cohort Effects in the Data

1980

College premium relative to 1980

1990

2000

2010
4. Role of Employment Protection
Effect of Turbulence with Employment Protection

- Introduce a firing cost.
- Calibrated to match long term tenure in Germany with same turbulence shock as in the US.
- Result: Increase in college premium 40% smaller.
Relative Return to Accumulation Vacancy

![Graph showing relative return to accumulation vacancy over experience with data points for 1980 and 2010. The graph plots experience on the x-axis and relative return on the y-axis. The data shows a decreasing trend with experience, with a peak in 1980 and a decline by 2010.]
Relative Return to Accumulation Vacancy with Firing Cost

Rel. ret. T to N vacancies

Experience

1980 2010 2010 with firing cost
Investment in Skill Upgrading

The graph shows the probability of skill upgrade as a function of experience. The solid line represents the probability of skill upgrade in 1980, while the dashed line represents the probability in 2010. The probability decreases as experience increases, with the 1980 curve showing a higher probability at all levels of experience compared to the 2010 curve.
Welfare as a Function of Firing Cost

The graph shows the welfare as a function of firing cost. There are two lines on the graph:

- The blue line represents the full effect.
- The red line represents the constant job composition.

The x-axis represents the firing cost, ranging from 0 to 3. The y-axis represents the welfare, ranging from 0.92 to 1.04 on the left panel and from 0.6 to 1 on the right panel.

The graph illustrates how welfare changes with increasing firing cost under different assumptions about job composition.
Conclusion

- Without protection, rise in turbulence erodes supply of skill-intensive jobs and raises education premium.
- Helps explain cross-country differences in inequality trends.