How Sticky Wages In Existing Jobs Can Affect Hiring

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1 Introduction

- Wages arguably sticky—but less so for new matches (Pissarides, 2009)

- Develop a Diamond-Mortensen-Pissarides model with wages flexible for new hires, but sticky within

- Depart from sticky-wage literature by firms/workers bargaining over effort/output
  - Not in wage: effort for hourly, hours or effort for salaried
  - Renders effective wage partly flexible
• In M-P model wage stickiness in existing jobs doesn’t matter—Doesn’t hold in our model
  — Wage stays high after negative shock; ask more of workers
  — Reduces payoff to hiring—G.E. effect

• Can get wide difference in effort by vintage, impact short-lived

• If constrain workers to have same effort/pace, impact much larger
  — Get considerable wage inertia/unemployment volatility
• Difficult to measure cyclicalilty of effort


• Anger (2011) unpaid overtime (extra) hours highly countercyclical for German workers for 1984 to 2004

• Lazear, Shaw, and Stanton (2013) examine productivity of 20,000 workers at services company for June 2006 to May 2010: increase in local unemployment rate of 5 percentage points increases productivity of 3.75%
• Our model consistent with productivity/wage response in great recession
  — 2007 to 2009, 10% decline in hours compared to 6% in output

• Goes part way in rationalizing Shimer puzzle
  — Gives bigger response in employment to productivity shock
  — Makes measured TFP respond much less to that shock

• Examine whether consistent with behavior of TFP across industries
  — Stratify industries by measures of wage stickiness
  — Stickier wages yields countercyclical TFP, more cyclical inputs
Model

- Diamond-Mortensen-Pissarides matching model
- Exogenous Separation
- Staggering Wage Contracts
- Wages Flexible for Newly Matched Workers
- Effort is chosen through Nash Bargaining
Workers’ Preferences

\[ E_0 \sum_{t=0}^{\infty} \beta^t \left\{ c_t + \psi \frac{(1 - e_t)^{1-\gamma} - 1}{1 - \gamma} \right\}, \]

- \( c \): consumption
- \( e \): effort
- \( \frac{e}{1 - e\gamma} \): Frisch elasticity of effort w.r.t. wage
Firms’ Production Technology

\[ y_t = z_t e^\alpha_t (k_t e_t)^{1-\alpha}, \]

- \( z_t \): aggregate productivity
- \( k_t \): capital per effort, equated over firms
- Aggregate capital fixed over cycle
Matching Technology

\[ M(u_t, v_t) = \chi u_t^{1/2} v_t^{1/2}, \]

Each period jobs are destroyed with exogenous probability \( \delta \).

Free Entry Condition

Vacancies posted until expected value of hire equals cost of vacancy.
Staggered Wage Contract

- When a match is formed, the wage is set according to a Nash bargaining.

- Wage is fixed for $T$ periods.
Choice of Labor Effort

- Effort is determined according to the Nash bargaining.

- We consider three cases:
  - Effort level is fixed
  - Effort level is chosen by worker vintage
  - Common level of effort chosen across vintages
Nash Bargaining over Wages of New Bargains

The wage for new matches, \( w^*(z, \mu) \), dictated by Nash bargain between set of workers and firm:

\[
w^*(z, \mu) = \arg\max_w \left[ \left( J_0(w; z, \mu) \right)^{1/2} \left( W_0(w; z, \mu) - U(z, \mu) \right)^{1/2} \right].
\]

First order condition for \( w^*(z, \mu) \) gives

\[
J_0(w^*; z, \mu) = W_0(w^*; z, \mu) - U(z, \mu).
\]
Choice of Effort

Given wage contract $w_j$, effort dictated by Nash bargain. By worker vintage:

$$e_j^*(w_j, z, \mu) = \arg\max_{e_j} \left( J_j(e_j; w_j, z, \mu) \right)^{1/2} \left( W_j(e_j; w_j, z, \mu) - U(z, \mu) \right)^{1/2}$$

First order condition for $e^*(z, \mu)$ gives

$$\psi(1 - e_j)^{-\gamma} J_j(e_j; w_j, z, \mu) = \alpha z k^{1-\alpha} \left( W_j(e_j; w_j, z, \mu) - U(z, \mu) \right)$$

For $w_j = w^*(z, \mu)$ have efficient effort

$$\psi(1 - e_j)^{-\gamma} = \alpha z k^{1-\alpha}$$
Model with Common Level of Effort

We also consider the model with common level of effort across workers.

- Maybe unrealistic to operate at varying work rules across employee.

- Complementarity of labor across workers
Bargaining over the Common Level of Effort

The common effort level, \( e(z, \mu) \), is determined by Nash bargaining over weighted average of surpluses across worker vintages.

\[
e^*(z, \mu) = \arg\max_{e} \left( J \right)^{1/2} \left( W - U \right)^{1/2},
\]

\[
J = \sum_{j=0}^{T-1} \frac{N_j}{\sum_{j=0}^{T-1} N_j} J_j,
\]

\[
W - U = \sum_{j=0}^{T-1} \frac{N_j}{\sum_{j=0}^{T-1} N_j} (W_j - U).
\]
Calibration: Key Parameters

- Contract length: $T = 4$

- Frisch Elasticity of Effort: $\frac{1(1-e)}{\gamma e} = 1$; $\psi$ so S.S. effort, $e = 1/2$

- Labor elasticity: $\alpha = 0.64$

- Benefit $b$ so replacement rate $b\left(\frac{1}{w_{ss} + \psi\left(\frac{1-e}{1-\gamma}\right)}\right) = 75\%$.

- Productivity Shock: $\rho_z = 0.95$
Impulse Responses to a 1% Decrease in Productivity

We will show models with:

- Fixed Effort (Flexible wage and Sticky wage)
- Endogenous Effort
  - Flexible wage
  - Sticky wage with individual effort level
  - Sticky wage with common effort level
Models with Fixed Effort
Aggregate Wage ($W$)
Wages for New Bargains ($w_0$)

- **Sticky Wage Fixed Effort**
- **Flexible Wage Fixed Effort**
Models with Variable Effort:

We consider cases with:

- Benchmark \((T = 4, \gamma = 1, \alpha = 0.64)\)
- Longer Contract Length \((T = 8)\)
- Smaller Frisch Elasticity \((\gamma = 2)\)
- Smaller Labor Demand Elasticity \((\alpha = 0.28)\)
Benchmark \((T = 4, \gamma = 1, \alpha = 0.64)\)
Aggregate Wage ($W$)

% deviation from steady state

- Sticky Wage Individual Effort
- Flexible Wage Endogenous Effort
Wages for New Bargains \((w_0)\)

- **Sticky Wage Individual Effort**
- **Flexible Wage Endogenous Effort**
Benchmark \((T = 4, \gamma = 1, \alpha = 0.64)\)
Longer Contract Length ($T = 8$)
New Matches (M)
Smaller Frisch Elasticity ($\gamma = 2$)
Smaller Labor Demand Elasticity ($\alpha = 0.28$)
Model Helps Explain Volatility of Unemployment for Measured Productivity

- Partly by making employment respond more

- Partly by making measured productivity less cyclical than shock
Productivity Shock = Measured TFP in US
Unemployment (Model vs US Data)

deviation from steady state (%)

Flexible Wage Endogenous Effort
U.S. Data

years:
Measured TFP (Model vs US Data)

% deviation from steady state


Sticky Wage Common Effort
U.S. Data
Productivity Shock = 1.8* Measured TFP in US
Measured TFP (Model vs US Data)

% deviation from steady state

-3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5

Sticky Wage Common Effort ($Z = 1.8 \cdot \text{US TFP}$)
U.S. Data

-3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5
3 Industry Wage and TFP Patterns

- Examine cyclicality of inputs, TFP, and wages by stickiness

\[
\begin{pmatrix}
x_{it} \\
y_{it} - x_{it} \\
w_{it}
\end{pmatrix} = \alpha Y_t + \beta [s_{it} - \bar{s}_{it}] Y_t + error_{it}
\]

- U.S. KLEMS Data for 60 Industries 1987-2010

- Measure wage stickiness by industry from frequency of wage changes in SIPP data
Correlation Cyclical Relative Wage and TFP

- Highly correlated for (HP) industry cycle
- Only in proportion to labor’s share
### Industry Wage and TFP Fluctuations

Dependent Variable = TFP for Value Added

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage</td>
<td>0.54</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>-0.08</td>
<td>0.09</td>
</tr>
<tr>
<td>Wage*Labor’s Share</td>
<td>1.13</td>
<td>0.15</td>
</tr>
</tbody>
</table>

60 industries by 24 years. Regressions include full set of year dummies. Industries weighted by value added.
Measuring Wage Stickiness

- Use 1990 to 2008 SIPP panels
  - Measure 4 and 8-month frequencies of change

- Allow for measurement error—assume change exactly reversed signifies error
  - Do under Calvo or Taylor: \( \alpha_C = \frac{\Delta_2 - \Delta_1}{1 - \Delta_1} \)
<table>
<thead>
<tr>
<th>Frequency of Wage Changes SIPP, 1990-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>4-month</td>
</tr>
<tr>
<td>1990-93 Panels (1990-95)</td>
</tr>
<tr>
<td>1996 Panel (1996-99)</td>
</tr>
<tr>
<td>2001 Panel (2001-04)</td>
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<tr>
<td>2004 Panel (2004-07)</td>
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<tr>
<td>2008 Panel (2008-11)</td>
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<td>Average all Panels</td>
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</tbody>
</table>
### Cyclicality by Industry Wage Stickiness

RHS variable is Duration(months)\(\times\)Aggregate Real GDP

<table>
<thead>
<tr>
<th></th>
<th>Inputs</th>
<th>TFP</th>
<th>Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All 60 Industries</strong></td>
<td>0.17</td>
<td>-0.29</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(.04)</td>
<td>(.10)</td>
<td>(.06)</td>
</tr>
<tr>
<td><strong>30 Low-Labor-Share</strong></td>
<td>0.13</td>
<td>-0.20</td>
<td>0.22</td>
</tr>
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<td>(.04)</td>
<td>(.15)</td>
<td>(.09)</td>
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<tr>
<td><strong>30 High-Labor-Share</strong></td>
<td>0.15</td>
<td>-0.45</td>
<td>0.20</td>
</tr>
<tr>
<td>Industries</td>
<td>(.07)</td>
<td>(.14)</td>
<td>(.08)</td>
</tr>
</tbody>
</table>
Conclusion

- Breaks irrelevance of sticky wage for current workers

- Matters quantatively when tie effort levels–gives a lot of wage inertia
  - Bigger employment response
  - Mutes procyclical productivity

- Industry wage stickiness matters for cyclicality of TFP for industries with important labor share