Downward Nominal Wage Rigidity in the OECD

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November 25, 2005
Motivation

- Conventional view: Long run Phillips curve is vertical. No long run relationship between inflation and unemployment.

- Challenging view: Nominal wages are rigid downwards (DNWR). At low inflation, DNWR leads to stronger wage pressure, inducing higher unemployment (Tobin).

- Important to study effects from DNWR because of monetary policy aiming at very low inflation and also nominal harmonisation in EMU.

- Wage stickiness in business cycle and monetary policy literature.
Motivation cont.

- Many economists view DNWR as ‘money illusion’ and ‘ad hoc’

- But: solid justifications have emerged

  - Fair treatment: employees and employers view nominal wage cuts as unfair (Kahneman; Akerlof, Dickens and Perry; Bewley). Supporting survey evidence

  - Contracts: Nominal wage contracts that can only be changed by mutual consent (MacLeod and Malcomson; Holden). DNWR with rational agents

- Supporting micro evidence for many countries
Motivation cont.

- A lot of micro evidence documents the existence of DNWR for many different countries, but
  - few studies for continental Europe (exceptions IWFP, Knoppik & Beissinger, Dessy)
  - difficult to compare results across countries due to different data and methods
  - more countries and longer time dimension makes it possible to explore the effect of institutional variables
  - rigidity for job stayers may also reflect selection bias, as those who take wage cuts may quit
  - firms can circumvent rigidity at individual level, by turnover, or by shifting jobs to other firms with lower wages

- Supplement micro data by industry panel data, where the unit of observation is the annual growth in average nominal gross hourly earnings for manual workers in the industry
Data

- Countries: at, be, ca, dew, dk, es, fi, fr, gr, ie, it, lu, nl, no, nz, pt, se, uk, us
- $\Delta w_{jit}$ where $j = \text{industry}$, $i = \text{country}$, $t = \text{year}$
- 449 country-year samples ($it$ combinations)
- 9509 observations in total of which
- 324 observations of nominal wage reductions
The idea

DNWR involves compression of the country-year wage growth distribution

■ To detect DNWR we must compare the observed wage change with the notional wage changes (wage change distribution without DNWR)

• Assume notional distribution is normal? Or symmetric? The Kahn test requires that the notional distribution is independent of inflation.

• We assume that the shape of the notional country-year specific wage change distribution takes the same form as the empirical wage change distribution in the high inflation years

• We construct notional distribution based on empirical country-year samples in high inflation years, adjusting for country-year specific median wage change and dispersion ($IPR = P75 - P35$).
The underlying distribution (left), empirical and notional distributions for Portugal 1998 (right)

\[ \Delta w^n_s = \frac{\Delta w_{jit} - M_{it}}{(P75 - P35)_{it}} \]

\[ \Delta \tilde{w}^n_{it} = \Delta w^n_s (P75 - P35)_{it} + M_{it} \]
Novel method

We find fewer wage cuts in the empirical sample than in the notional, suggesting that DNWR has prevented wage cuts.

Is this difference significant? Novel statistical method:

1. Count number of observed wage cuts
2. Construct probability of a wage cut from notional sample in each country-year, i.e. 449 notional probabilities.
3. Use notional probabilities to undertake 5000 Monte Carlo simulations over the 449 country-year samples, and count the total number of simulated wage cuts.
4. Evidence of DNWR if ‘sufficiently often’ more simulated wage cuts than observed.
Results from 5000 simulations

- In 5000 simulations there were more simulated wage cuts than observed. Probability of significance = 0

- On average, we simulate 395 wage cuts, as compared to 324 observed wage cuts. Fraction of wage cuts prevented $FWCP = 1 - 324/395 = 0.18$. 

![Histogram of simulated total wage cuts](image)
Results on regions

Sample properties:

<table>
<thead>
<tr>
<th></th>
<th>All regions</th>
<th>Anglo</th>
<th>Core</th>
<th>Nordic</th>
<th>South</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of observations ($S$)</td>
<td>9509</td>
<td>2961</td>
<td>3110</td>
<td>1976</td>
<td>1462</td>
</tr>
<tr>
<td>No. of country-years</td>
<td>449</td>
<td>129</td>
<td>158</td>
<td>95</td>
<td>67</td>
</tr>
<tr>
<td>Observed wage cuts ($Y$)</td>
<td>324</td>
<td>153</td>
<td>125</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td>Incidence of wage cuts ($Y/S$)</td>
<td>0.0341</td>
<td>0.0517</td>
<td>0.0402</td>
<td>0.0091</td>
<td>0.0192</td>
</tr>
</tbody>
</table>

Simulation results:

<table>
<thead>
<tr>
<th></th>
<th>All regions</th>
<th>Anglo</th>
<th>Core</th>
<th>Nordic</th>
<th>South</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average simulated wage cuts ($\hat{Y}$)</td>
<td>395.4</td>
<td>173.7</td>
<td>149.3</td>
<td>31.8</td>
<td>40.5</td>
</tr>
<tr>
<td>#$($\hat{y} &gt; y^B$)</td>
<td>5000</td>
<td>4807</td>
<td>4948</td>
<td>4984</td>
<td>4883</td>
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<tr>
<td>Probability of significance</td>
<td>0</td>
<td>0.039</td>
<td>0.10</td>
<td>0.003</td>
<td>0.023</td>
</tr>
<tr>
<td>Fraction of wage cuts prevented ($FWCP$)</td>
<td>0.181</td>
<td>0.119</td>
<td>0.163</td>
<td>0.435</td>
<td>0.309</td>
</tr>
<tr>
<td>Fraction of industry-years affected ($FIYA$)</td>
<td>0.008</td>
<td>0.007</td>
<td>0.008</td>
<td>0.007</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Anglo: Canada, Ireland, New Zealand, UK and US
Core: Austria, Belgium, Germany, France, Netherlands and Luxembourg
Nordic: Denmark, Finland, Norway and Sweden
South: Greece, Italy, Portugal, Spain
## Results on periods

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>No. of observations ($S$)</td>
<td>2224</td>
<td>3717</td>
<td>1906</td>
<td>1662</td>
</tr>
<tr>
<td>No. of country-years</td>
<td>109</td>
<td>175</td>
<td>88</td>
<td>77</td>
</tr>
<tr>
<td>Average wage growth</td>
<td>13.78%</td>
<td>8.72%</td>
<td>5.60%</td>
<td>3.99%</td>
</tr>
<tr>
<td>Average inflation rate</td>
<td>10.30%</td>
<td>8.13%</td>
<td>4.42%</td>
<td>2.19%</td>
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<tr>
<td>Average unemployment rate</td>
<td>3.71%</td>
<td>6.72%</td>
<td>8.49%</td>
<td>8.07%</td>
</tr>
<tr>
<td>Observed wage cuts ($Y$)</td>
<td>5</td>
<td>74</td>
<td>93</td>
<td>152</td>
</tr>
<tr>
<td>Incidence of wage cuts ($Y/S$)</td>
<td>0.0023</td>
<td>0.0199</td>
<td>0.0488</td>
<td>0.0915</td>
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</table>

<table>
<thead>
<tr>
<th>Simulation results:</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average simulated wage cuts ($\hat{Y}$)</td>
<td>12.8</td>
<td>107.7</td>
<td>109.4</td>
<td>165.5</td>
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<tr>
<td>$#$($\hat{y} &gt; y^B$)</td>
<td>4937</td>
<td>4998</td>
<td>4815</td>
<td>4422</td>
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<tr>
<td>Probability of significance ($p$)</td>
<td>0.013</td>
<td>0.000</td>
<td>0.037</td>
<td>0.116</td>
</tr>
<tr>
<td>Fraction of wage cuts prevented ($FWCP$)</td>
<td>0.609</td>
<td>0.313</td>
<td>0.150</td>
<td>0.082</td>
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<tr>
<td>Fraction of industry-years affected ($FIYA$)</td>
<td>0.003</td>
<td>0.009</td>
<td>0.009</td>
<td>0.008</td>
</tr>
</tbody>
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## Results on countries

<table>
<thead>
<tr>
<th>Country</th>
<th>$S$</th>
<th>$T$</th>
<th>$Y$</th>
<th>$Y/S$</th>
<th>$\hat{Y}$</th>
<th>$#(\hat{y} &gt; y^B)$</th>
<th>$p$</th>
<th>FWCP</th>
<th>FIYA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>408</td>
<td>26</td>
<td>2</td>
<td>0.0049</td>
<td>6.0</td>
<td>4714</td>
<td>0.057</td>
<td>0.664</td>
<td>0.010</td>
</tr>
<tr>
<td>Belgium</td>
<td>575</td>
<td>26</td>
<td>31</td>
<td>0.0539</td>
<td>38.1</td>
<td>4620</td>
<td>0.076</td>
<td>0.187</td>
<td>0.012</td>
</tr>
<tr>
<td>Canada</td>
<td>627</td>
<td>26</td>
<td>57</td>
<td>0.0909</td>
<td>57.3</td>
<td>2419</td>
<td>0.516</td>
<td>0.005</td>
<td>0.000</td>
</tr>
<tr>
<td>Denmark</td>
<td>462</td>
<td>24</td>
<td>8</td>
<td>0.0172</td>
<td>12.4</td>
<td>4380</td>
<td>0.124</td>
<td>0.353</td>
<td>0.009</td>
</tr>
<tr>
<td>Finland</td>
<td>368</td>
<td>23</td>
<td>2</td>
<td>0.0054</td>
<td>5.1</td>
<td>4437</td>
<td>0.113</td>
<td>0.609</td>
<td>0.008</td>
</tr>
<tr>
<td>France</td>
<td>556</td>
<td>26</td>
<td>21</td>
<td>0.0378</td>
<td>16.5</td>
<td>389</td>
<td>0.922</td>
<td>–0.275</td>
<td>–0.008</td>
</tr>
<tr>
<td>Germany</td>
<td>665</td>
<td>26</td>
<td>16</td>
<td>0.0241</td>
<td>15.0</td>
<td>1681</td>
<td>0.664</td>
<td>–0.065</td>
<td>–0.001</td>
</tr>
<tr>
<td>Greece</td>
<td>469</td>
<td>26</td>
<td>7</td>
<td>0.0149</td>
<td>5.6</td>
<td>992</td>
<td>0.802</td>
<td>–0.260</td>
<td>–0.003</td>
</tr>
<tr>
<td>Ireland</td>
<td>463</td>
<td>23</td>
<td>27</td>
<td>0.0583</td>
<td>35.0</td>
<td>4612</td>
<td>0.078</td>
<td>0.229</td>
<td>0.017</td>
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<tr>
<td>Italy</td>
<td>312</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>3.0</td>
<td>4763</td>
<td>0.047</td>
<td>1</td>
<td>0.010</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>423</td>
<td>27</td>
<td>32</td>
<td>0.0757</td>
<td>39.1</td>
<td>4498</td>
<td>0.100</td>
<td>0.183</td>
<td>0.017</td>
</tr>
<tr>
<td>Netherlands</td>
<td>483</td>
<td>27</td>
<td>23</td>
<td>0.0476</td>
<td>34.6</td>
<td>4965</td>
<td>0.007</td>
<td>0.335</td>
<td>0.024</td>
</tr>
<tr>
<td>New Zealand</td>
<td>750</td>
<td>27</td>
<td>45</td>
<td>0.0600</td>
<td>52.3</td>
<td>4244</td>
<td>0.151</td>
<td>0.139</td>
<td>0.010</td>
</tr>
<tr>
<td>Norway</td>
<td>674</td>
<td>27</td>
<td>2</td>
<td>0.0030</td>
<td>3.5</td>
<td>3395</td>
<td>0.321</td>
<td>0.431</td>
<td>0.002</td>
</tr>
<tr>
<td>Portugal</td>
<td>411</td>
<td>18</td>
<td>3</td>
<td>0.0073</td>
<td>18.0</td>
<td>5000</td>
<td>0.000</td>
<td>0.834</td>
<td>0.037</td>
</tr>
<tr>
<td>Spain</td>
<td>270</td>
<td>10</td>
<td>18</td>
<td>0.0667</td>
<td>14.0</td>
<td>539</td>
<td>0.892</td>
<td>–0.289</td>
<td>–0.015</td>
</tr>
<tr>
<td>Sweden</td>
<td>472</td>
<td>21</td>
<td>6</td>
<td>0.0127</td>
<td>10.9</td>
<td>4752</td>
<td>0.050</td>
<td>0.447</td>
<td>0.010</td>
</tr>
<tr>
<td>UK</td>
<td>615</td>
<td>26</td>
<td>18</td>
<td>0.0293</td>
<td>21.7</td>
<td>3987</td>
<td>0.203</td>
<td>0.171</td>
<td>0.006</td>
</tr>
<tr>
<td>US</td>
<td>506</td>
<td>27</td>
<td>6</td>
<td>0.0119</td>
<td>7.4</td>
<td>3062</td>
<td>0.388</td>
<td>0.190</td>
<td>0.003</td>
</tr>
</tbody>
</table>
Robustness

- Country specific and period specific underlying distributions
- Contaminating the data

  - Adding downward nominal wage rigidity:
    Our measure is able to detect 93% of additional DNWR

  - Adding downward real wage rigidity:
    Adding 20% DRWR increases FWCP by only 6 percentage points.

  - Adding noise (capturing compositional changes) weakens the evidence of DNWR.
Can labour market institutions explain the number of (observed) wage cuts ($Y_{it}$)?

\[ Y_{it} \sim \text{Poisson}(\lambda_{it}) \text{ where } \lambda_{it} \sim \Gamma(\gamma_{it}, \delta_i) \]  

(1)

where

\[ \gamma_{it} = \exp \left\{ \beta_1 EPL_{it} + \beta_2 UD_{it} + \beta_3 \Delta cpi_{it} + \beta_4 (\Delta cpi_{it})^2 + \beta_5 U_{it} \right\} \]  

(2)

Allow for industry specific effects and ‘overdispersion’.

Log-likelihood estimation of the $\beta$s conditional on $\sum_t Y_{it}$
<table>
<thead>
<tr>
<th></th>
<th>Incidence of wage cuts</th>
<th></th>
<th>Fraction of wage cuts realised</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled</td>
<td>Fixed effects</td>
<td>Pooled</td>
<td>Fixed effects</td>
</tr>
<tr>
<td>Ln($S_{it}$)</td>
<td>1 (-)</td>
<td>1 (-)</td>
<td>1 (-)</td>
<td>1 (-)</td>
</tr>
<tr>
<td>Ln(Simulated cuts)</td>
<td>-</td>
<td>-</td>
<td>1 (-)</td>
<td>1 (-)</td>
</tr>
<tr>
<td>EPL</td>
<td>-0.310* (0.104)</td>
<td>-0.785* (0.200)</td>
<td>-0.096 (0.058)</td>
<td>-0.395 (0.288)</td>
</tr>
<tr>
<td>Union density</td>
<td>-0.803 (0.598)</td>
<td>-1.992* (0.980)</td>
<td>-0.941* (0.376)</td>
<td>-1.870 (1.394)</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.484* (0.073)</td>
<td>-0.345* (0.062)</td>
<td>-0.068 (0.047)</td>
<td>-0.025 (0.062)</td>
</tr>
<tr>
<td>Inflation squared</td>
<td>0.016* (0.003)</td>
<td>0.011* (0.003)</td>
<td>0.003 (0.002)</td>
<td>0.002 (0.003)</td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.116* (0.029)</td>
<td>0.092* (0.036)</td>
<td>0.032* (0.016)</td>
<td>0.007 (0.035)</td>
</tr>
<tr>
<td>constant</td>
<td>1.092* (0.463)</td>
<td>1.855* (0.762)</td>
<td>0.208 (0.242)</td>
<td>—</td>
</tr>
<tr>
<td>log-likelihood</td>
<td>-364.6</td>
<td>-288.5</td>
<td>-279.3</td>
<td>-231.4</td>
</tr>
<tr>
<td>Number of observations</td>
<td>422</td>
<td>409</td>
<td>416</td>
<td>403</td>
</tr>
</tbody>
</table>

Weakening EPL in Portugal from strict to medium level would raise incidence of nominal wage cuts from 0.7 to 2.3 percent.
Conclusions I

- Statistically significant DNWR in industry level data indicates that firm behaviour and market mechanisms may diminish, but do not seem to remove, rigidity at individual level.

- periods: 1973–79, 1980–89 and 1990–94 at 5% level
- regions: Core, Nordic, South and Anglo at 5% level,
- countries: Italy, Netherlands, Portugal and Sweden at 5% level, Austria, Belgium, Ireland and Luxembourg at 10% level
Conclusions II

- high inflation, strict employment legislation, low unemployment, and high union density have significant
  - negative effect on the incidence of nominal wage cuts
  - positive effect on the fraction of wage cuts prevented

- Supports contract explanations of DNWR
Conclusions III

- The fraction of wage cuts prevented has fallen over time, from 60 percent in the 1970s to 8 percent in the late 1990s...

  ... except in Nordic countries, where fraction of wage cuts prevented has increased

- the fraction of industries affected by DNWR has been stable at about 1% in the 80s and 90s, but was smaller in the 70s.

- Method seems capable of detecting most DNWR, and distinguishing DNWR from DRWR.