Wage cyclicality

Katarína Borovičková

New York University

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Outline

1. A few comments on wage rigidities
2. Empirical evidence on cyclicality of wages
3. Evidence on persistent wage effects of past conditions

A few comments

Wage rigidity in search models

- in standard MP model, workers and firms are risk-neutral
- consequence: only PDV of wages matters, not the timing, as long as separations are efficient
- example (Shimer (2004) has more details)
  - wage in new matches is determined by Nash bargaining, but it never changes following subsequent shocks
  - equation for θ is not affected because the surplus does not depend on initial productivity level
  - timing of wages changes, PDV of wages does not change
- this is conditional on the fact that a firm and worker are still willing to stay in a match at the given wage, and do not prefer to separate
- ideally, you we want to see if PDV of wages responds to productivity shocks - impossible to measure
- focus on new hires rather than stayers

How to interpret evidence for wage rigidity?

- the usual approach to wage rigidity is to examine cyclicality of wages
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How to interpret evidence for wage rigidity?

- the usual approach to wage rigidity is to examine cyclicality of wages
- if wages move close to one-to-one with labor productivity, wages are said to be flexible
- but this is not necessarily correct
- consider an otherwise frictionless model, where wage w_t is above market-clearing level
- firms have CD technology, choose n_t to equalize MPL to wage

$$w_t = MPL_t = (1 - \alpha)\frac{y_t}{n_t}$$

- wage moves one-to-one with measured labor productivity!

How to interpret evidence for wage rigidity?

- this does not carry over exactly to a model with search frictions but it is close
- Shimer (2010, Chapter 4) considers a (ad hoc) rigid wage

$$w(s^t) = rw(s^{t-1})e^{\bar{s}} + (1-r)w^*(s^t),$$

  - $w(s^t)$ actual wage
  - $w(s^{t-1})$ past wage
  - $w^*(s^t)$ target wage given by Nash bargaining

- standard deviation of labor share relative to that of output

	$r = 0$	$r = 0.95$ finite sample	$r = 0.95$ infinite sample	$r = 0.993$ infinite sample
st.dev of wn/y	0.012	0.144	0.300	0.144

- wage and measured labor productivity close to being proportional despite extreme wage rigidity
- hence, finding that wages move as much as labor productivity does not say much about relevance of wage rigidity for employment fluctuations

How much wage rigidity do we need?

- Shimer (2010, Chapter 4) finds that wn/y declines only modestly in expansion even with extreme wage rigidity
- hence, measured labor productivity y/n increases only slightly more than w
- empirical studies: look at co-movement of w and y/n
- hence, it is enough if w are only slightly more rigid than measured y/n to generate fluctuations in employment
- empirical studies do not test whether "wages are rigid enough" to get large fluctuations

Empirical studies of wage rigidity

Typical studies of wage rigidity

- regression model

$$lnw_{it} = X_{it}\beta_x + \beta_u U_t + \beta_n U_t I_{it}^{nh} + \eta_t + \nu_{it} \quad (1)$$

- where

w_{it}	wage for worker i at time t
X_{it}	worker characteristics
I_{it}^{nh}	indicator for a new hire
η_t, ν_{it}	error terms
U_t	unemployment rate (or other cyclical measure) at time t

- β_u - cyclicality of job stayers
- $\beta_u + \beta_n$ - cyclicality of new hires

Older studies on wage cyclicality

- Bils (1985) uses NLS data from 1966 to 1980
- estimates (1) in first differences – hence only workers who have jobs in 2 consecutive periods
- distinguish job stayers and job movers
- semi-elasticity of wages wrt unemployment rate for white men

$$\beta^{all-workers} = -1.59, \quad \beta^{stayers} = -0.64, \quad \beta^{job-switchers} = -3.69$$

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- Shin (1994), NLS 1966–1981, different estimation methods ; similar to Bils(1985)
- Solon, Barsky, Parker(1994), PSID 1967–1987

$$\beta^{all-workers} = -1.4, \quad \beta^{stayers} = -1.24$$

Interpretation

- Pissarides (2007): wages of new hires within a given firm are more sensitive than those of stayers
- Gertler and Trigari (2009): composition effect
  - data include only workers, not firms: not possible to compare hires within the same firm
  - cyclical changes in the composition of job quality: new matches have a higher quality in booms than in recessions
- example
  - high-skilled worker takes a low-pay job in a recession, and then re-employed again at a high-skill job
  - this is not captured by the standard specification
- employer and worker fixed effects do not help - need to include match-specific fixed effects
  - jobs need to be long enough
  - PSID 1990–1996; 3,000 observations on new hires
  - β_n small and insignificant

Gertler, Trigari (2009) - results

TABLE 6
BASELINE FIXED-EFFECTS SPECIFICATION

	Person Fixed Effect (1)	Person-Job Fixed Effect (2)
Unemployment rate	−.00564***	−.00576***
	(.0010)	(.0009)
Unemployment rate · I(new)	−.01042***	.00193
	(.0038)	(.0037)
Observations	125,941	122,026
Number of groups	17,897	18,234
Minimum number of observations per group	2	2
Maximum number of observations per group	9	9
Mean number of observations per group	7.037	6.692

SOURCE.—SIPP, 1990–93.
* Significant at 10 percent.
** Significant at 5 percent.
*** Significant at 1 percent.

source: Gertler and Trigari (2009)

Haefke, Sonntag, van Rens (2013)

- focus on newly hired workers – those who come from non-employment – rather than job switchers
- this is more in line with search models
- control for composition of employed workers over the cycle

$$\ln w_{it} = x_i' \beta + \ln \hat{w}_{it}$$

  where x_i is personal characteristic
- consider two subgroups: newly hired workers and stayers
- use residual wages $\ln \hat{w}_{it}$ to construct a wage index for each subgroup j

$$\ln \hat{w}_{jt} = \ln w_{jt} - (x_{jt} - \bar{x}_{jt})' \beta$$

- data: CPS, years 1984–2006

Haefke, Sonntag, van Rens (2013)

Table 4
Response of wages to productivity.

	Wage per hour		Earnings per person	
	All workers	New hires	All workers	New hires
Elasticity wrt productivity	0.24	0.79	0.37	0.83
Std. error	0.14	0.40	0.17	0.51
Observations	1 566 161	117 243	1 566 161	117 243
Quarters	83	83	83	83

Elasticities are estimated using the two-step method described in the text. The number of observations is the number of individual workers in the first step. Labor productivity is output per hour in the non-farm business sector from the BLS productivity and cost program. For the hourly wage we use labor productivity per hour and for regressions of earnings per person we use labor productivity per person. The second step includes seasonal dummies.

Carneiro, Guimaraes, Portugal (2012)

- matched employee-employer data from Portugal, 1986–2007
- earnings and hours worked in the reference month
- uniqe identifiers for employers and workers
- detailed occupational classification
- control for worker, firm, occupation fixed effects

Large dataset

- 3 millions workers, 350,000 firms per year
- 30,000 occupational categories
- 26.4 mil observations on job stayers
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- specification

$$\begin{aligned} lnw_{ijft} &= \lambda_i + \theta_j + \gamma_f + x_{it}\beta + \alpha_0 t + \alpha_1 t^2 \\ &= \phi hire_{ijft} + \xi_s cycle_t + \xi_h cycle_t \times hire_{ijft} + u_{ijft} \end{aligned}$$

- individual i, job j, firm f, time t
- annual data, $hire_{ijft}$ tenure less than 12 months
- $cycle_t$ - unemployment rate, job-finding rate, separation rate

Variation in explanatory variables

TABLE A—UNEMPLOYMENT RATE, JOB FINDING PROBABILITY, JOB SEPARATION PROBABILITY, AND AGGREGATE LABOR PRODUCTIVITY, PORTUGAL, 1985–2006

	Unemployment rate (in percent)	Job finding probability (in percent)	Job separation probability (in percent)	Real aggregate labor productivity per worker
1985	7.18	12.4	1.35	4.44
1986	7.42	17.4	1.41	4.61
1987	6.53	21.1	1.30	4.89
1988	5.72	20.3	1.16	5.02
1989	4.50	20.0	1.14	5.28
1990	5.10	25.7	1.24	5.40
1991	4.73	26.4	1.16	5.48
1992	3.89	21.1	1.26	5.51
1993	4.94	15.0	1.40	5.68
1994	5.96	17.5	1.59	5.78
1995	6.25	15.3	1.30	5.85
1996	6.35	15.1	1.23	5.92
1997	5.84	21.4	1.37	6.07
1998	4.95	26.2	1.26	6.18
1999	4.40	25.1	1.24	6.27
2000	3.90	24.4	1.11	6.32
2001	4.00	25.7	1.35	6.29
2002	5.00	19.5	1.71	6.35
2003	6.25	21.6	1.67	6.40

Results

TABLE 1—REAL WAGE SENSITIVITY TO THE UNEMPLOYMENT RATE
Dependent variable: log *real hourly earnings* (*Portugal*, *1986–2007*, $N = 31{,}631{,}954$)

	Stayers	Incremental effect for new hires
1. OLS estimator		
Cycle variable: unemployment rate	−1.61***	−0.38
	(0.53)	(0.22)
2. Within estimator, worker fixed effect		
Cycle variable: unemployment rate	−1.87***	−0.60***
	(0.56)	(0.16)
3. OLS solution with worker and firm fixed effects		
Cycle variable: unemployment rate	−1.85***	−0.75***
	(0.56)	(0.22)
4. OLS solution with worker, firm, and job title fixed effects		
Cycle variable: unemployment rate	−2.20***	−0.47***
	(0.60)	(0.16)
5. OLS solution with worker and firm-job title fixed effects		
Cycle variable: unemployment rate	−2.18***	−0.44***
	(0.63)	(0.15)

Note: Cluster-robust standard errors in parentheses.
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Gerlter, Huckfeldt, Trigari (2014)

- distinguish E-E and E-N-E transitions
  - no new hire effect for E-N-E
  - no new hire effect for E-E when controlling for match quality
- model with staggered wage bargaining rationalizes these results
- cyclicality of new hires is a composition bias

Effect of past labor market conditions on wages

Beaudry and DiNardo (1991)

- influential paper
- past labor market conditions affect current wages
- estimate

$$lnw_{i,t_0,t} = X_{i,t_0,t}\beta_x + \beta_u U_t + \beta_{t_0} U_{t0} + \beta_{min} \min_{s=t_0}^{t}\{U_s\} + \eta_t + \nu_{it}$$

- worker i in current period t hired in t_0
- question: are β_{t_0} and β_{min} large and significant?
- if yes, past labor market conditions matter, which is interpreted as wage rigidity

Implicit wage contracts

- risk-neutral firm, risk-averse worker
- three extreme contractual environments
- pure spot market: wages should depend only on current conditions
- till-the-death-do-us-part contract
  - no contingencies
  - wages should depend only on conditions at the beginning of the contract
- "costless mobility"
  - firm can commit to the contract, worker cannot
  - firms is risk-neutral, worker is risk-averse
  - firms insulate workers from recessions - no wage cuts
  - in expansions, wages are updated upwards to deter worker from quitting
  - wages depend on the best economic conditions since the beginning of the contract

BD(1991) results

- PSID 1976 – 1984
- usual controls in X
- main results
- if only U_t is included, $\beta_u = -1.4$, in line with previous studies
- if all three measures are included
  - $\beta_{min} = -2.9$, large and stat. significant
  - $\beta_{t_0} = -0.6$, not stat. significant
  - $\beta_u = -0.7$, stat. significant
- Gertler and Trigari (2009) claim that the result goes away if tenure is properly controlled for
- Hagedorn and Manoskii (2013) challenge the interpretation of these results as wage stickiness

Hagedorn and Manovskii (2013)

- omitted variable – match quality
- U_{t0} and $\min_{s=t_0}^{t} U_s$ are proxies for the match quality
- wage depends only on match quality and current labor market conditions
- endogenous distribution of current match productivities depends on past labor market tightness
  - theory-motivated measures of past labor market conditions
  - run a horse-race in a BD-type regression, their measure knocks out past unemployment

Model

- log-lin approximation: $logw_t^i = \alpha \log \theta_t + \beta \log \epsilon_t^i$
- workers receive offers
  - unemployed at rate λ_θ
  - employed at rate q_θ
  - at most M offers per period
  - $\varepsilon \sim F$, expected value μ_ϵ
- employed worker accepts if $\epsilon' > \epsilon_t^i$
- employment cycle: total time of continuous employment
- define
  - q_t^{EM}: sum of q in employment cycle up to current job
  - q_t^{HM}: sum of q in current job
- series of linear approximations

$$\log(\epsilon) \approx \tilde{c}_0 + \tilde{c}_1 \log(q^{HM}) + \tilde{c}_2 \log(q^{EM})$$

Intuition

- lowest unemployment rate is negatively correlated with the number of job offers, it has explanatory power for wages
- similarly logic for unemployment rate at the beginning of the spell
- wages of new hires are cyclically more sensitive than that of stayers because workers sample from a larger pool of offers in a boom, and workers with lower match-quality (over-represented among recent hires) benefit more from the increased pace of offers in a boom
- q^{EM}, q^{HM} measure expected number of offers a worker received, which is in turn measures an expected match quality

Model

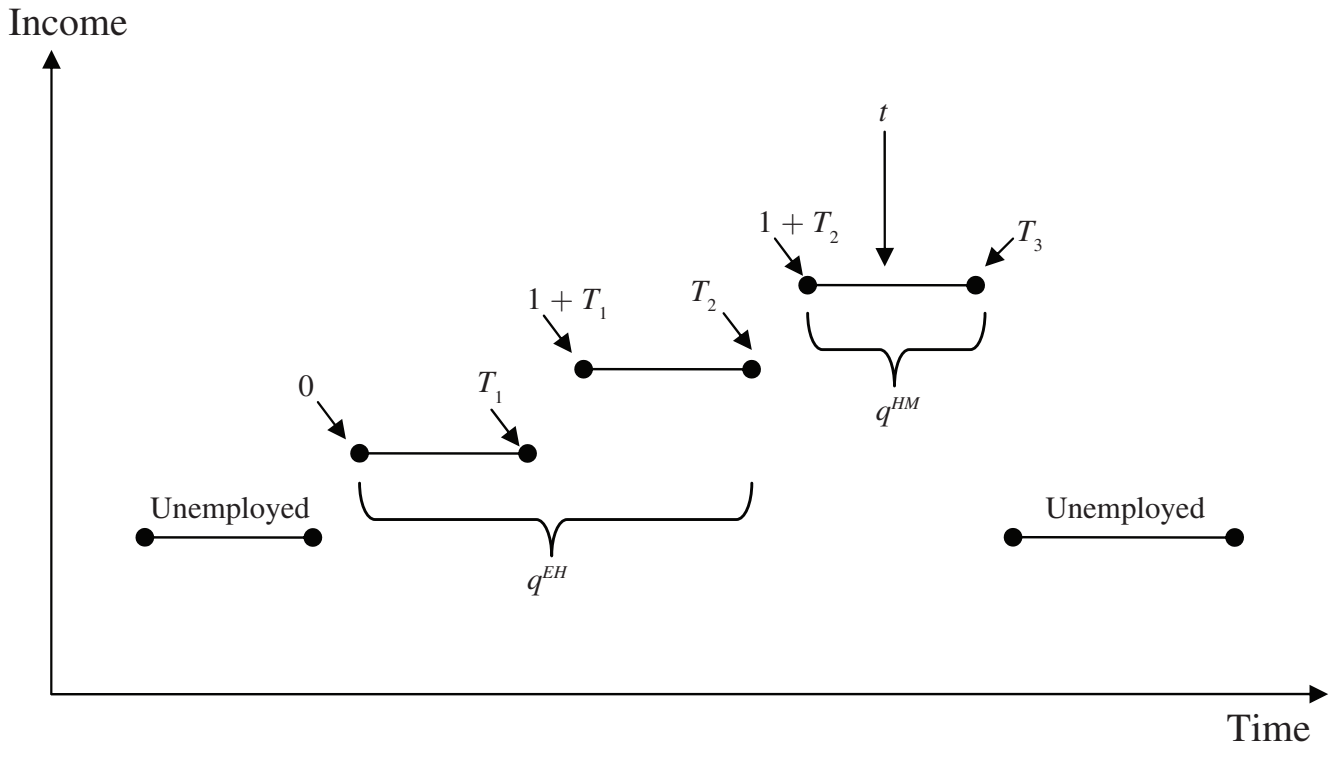

FIGURE 1. q_t^{HM} AND q_t^{EH} FOR AN EMPLOYMENT CYCLE WITH THREE JOBS AT TIME t

Results

TABLE 1—CONTROLLING FOR MATCH QUALITIES IN BEAUDRY-DINARDO REGRESSIONS

	Specification					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
u	**−3.455**	**−1.866**	**−1.804**	**−1.864**	**−2.884**	**−1.839**
	(0.528)	(0.445)	(0.790)	(0.714)	(0.598)	(0.505)
u^{min}	—	—	**−2.439**	−0.004	—	—
	—	—	(0.781)	(0.703)	—	—
u^{begin}	—	—	—	—	**−1.039**	−0.052
	—	—	—	—	(0.399)	(0.366)
q^{HM}	—	**7.418**	—	**7.418**	—	**7.412**
	—	(0.472)	—	(0.462)	—	(0.469)
q^{EH}	—	**2.834**	—	**2.833**	—	**2.822**
	—	(0.502)	—	(0.522)	—	(0.527)

Notes: Standard errors in parentheses. All coefficients and standard errors are multiplied by 100.

Simplifying assumptions in HM (2013)

- workers are passive in the wage offer process
  - they cannot increase arrival of offers when match is bad
- HM don't model wage-generating process
  - distribution F fixed over the business cycle
- is tightness a sufficient statistics for the LM conditions?
- do the test have power against other forms of wage rigidity?

Summarizing

- there are other papers which show (more persuasively than BD) that past LM conditions matter
- graduating in recession has a permanent effect on wages (Kahn (2010), Oreopoulos et. al. (2012))
- interpretation of the evidence
  - wages are rigid, they depend on the history of labor market conditions – labor contracts, collective bargaining, unions
  - wages depend only on the current labor market conditions, and the past conditions affect the current match quality distribution, and accumulation of human capital