

Reservation wages and the wage flexibility puzzle

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The wage flexibility puzzle: Introduction

- ▶ The search-and-matching labor market model (DMP) struggles to quantitatively match the relatively large unemployment fluctuations and mild cyclical of wages
- ▶ Shimer (2005) noted that the canonical model is unable to deliver the observed unemployment volatility in response to productivity shocks of plausible magnitudes.
- ▶ Ensuing “Shimer” or **unemployment volatility puzzle**: emphasizing the role of wage rigidity in accounting for the volatility of unemployment and job vacancies
- ▶ In models with search frictions wage stickiness is the sole determinant of unemployment volatility (Hall and Milgrom 2008).
 - ▶ unemployment volatility and wage stickiness: two sides of the same coin
 - ▶ puzzle can be rephrased as **wage flexibility puzzle**

Our approach

- ▶ Wages indeed are not very responsive to business cycle
 - ▶ Benchmark estimate of unemployment elasticity of wages: -0.1 (Blanchflower and Oswald 1994)
 - ▶ not a universal constant but in the right ballpark
 - ▶ shocks to labor demand have a much larger short-run impact on unemployment rather than wages.
- ▶ Very large literature addressing the wage flexibility puzzle by introducing rigidities directly into wage-setting
- ▶ We address the puzzle by explicitly considering the **role of reservation wages** in the canonical model
 - ▶ and modify the canonical model by introducing **backward-looking reference-dependence** in their determination.
- ▶ Shifting cyclical question directly on reservation wages provides new insight on puzzle

The role of reference points

- ▶ In the **canonical model**, reservation wages are forward-looking, determined by current and future labor market conditions.
- ▶ Introducing **reference dependence in job search** – shaped e.g. by previous employment history – generates less cyclical reservation wages than the canonical model *if reference points are less cyclical than labor market conditions*.
 - ▶ If a worker who lost job at the start of recession forms future wage aspirations based on pre-recession earnings, she would set her reservation wage above the level implied by purely forward-looking preferences.
- ▶ As a consequence, reservation wages may not fall in a recession as much as the canonical model predicts
- ▶ Reference dependence received increasing attention in labor supply (eg Farber 2008)
- ▶ In job search context: Falk et al (2004); Della Vigna et al (2016).

Related work

- ▶ Elements of wage stickiness improve predictions of canonical search model
- ▶ Simplest element of stickiness: high replacement ratios (Hagedorn and Manovskii, 2008). But implied replacement ratios are implausibly high (0.95).
- ▶ Approach criticized by Costain and Reiter (2008) as it delivers excess sensitivity of unemployment to policy changes.
- ▶ Other fixes: Weakly cyclical hiring costs (Pissarides 2009).
- ▶ Infrequent wage negotiations in ongoing job matches (Pissarides 2009; Rudanko 2009; Haefke et al 2013; Kudlyak 2014)
- ▶ Backward-looking elements in wage negotiations in new matches (Gertler and Trigari, 2009, do both)
- ▶ But: these are not sufficient

Outline and summary

1. Develop search model that embodies previous elements of wage rigidity and allows for reference-dependence in reservation wages
2. Derive predictions for cyclicalities of wages and reservation wages
 - ▶ Canonical model predicts elasticity of wages and reservation wages to unemployment of about -0.25 and -0.30 respectively
 - ▶ Elasticities greatly reduced by reference dependence
3. Show evidence on these predictions from micro data on (reservation) wages for UK and Germany
 - ▶ Wage elasticity to unemployment about -0.17 (max) in UK, lower in Germany
 - ▶ Reservation wage elasticity to unemployment about -0.15 (max) in UK, lower in Germany
4. Provide evidence on reference dependence in reservation wages
5. Propose solution to the wage flexibility puzzle using estimates obtained

Approach

Approach is general in a few aspects:

- ▶ allows for infrequent wage negotiation and backward-looking wage setting (recognized elements of wage rigidity);
- ▶ focuses on a general relationship between wages and unemployment (wage curve)
 - ▶ can be obtained from Nash bargaining in search model, but also consistent with alternative wage setting models; and can be easily estimated
- ▶ does not require to estimate a relationship between productivity shocks and unemployment.

The model

Matching model with wage rigidity

(Pissarides, 2009; Gertler and Trigari, 2009; etc.)

- ▶ Upon hire, only a fraction of wages are newly negotiated.
 - ▶ The rest of hires are paid an “old” wage, from pre-existing wage distribution.
- ▶ Afterwards, opportunities to renegotiate wages happen infrequently.
 - ▶ A fraction of wages in the economy reflect past negotiations.
- ▶ Both assumptions have implications for cyclicity.

Introduce **reference-dependent reservation wages** in this set-up

Model: Firms

- ▶ Wages in new jobs are negotiated with probability α , and opportunity to renegotiate wages in existing jobs arrives at Poisson rate ϕ
- ▶ Assumptions only relevant out of steady state
- ▶ Value of a vacant job at time t , $V(t)$

$$rV(t) = -c(t) + q(t) \left[\begin{array}{c} \alpha J(t; w_r(t)) + (1 - \alpha)J(t; w_a(t)) \\ -V(t) - C(t) \end{array} \right] + E_t \dot{V}(t)$$

- ▶ Value at time t of a job paying w , $J(t; w)$

$$rJ(t; w) = p(t) - w - s [J(t; w) - V(t)] + \phi [J(t; w_r(t)) - J(t; w)] + E_t \dot{J}(t)$$

- ▶ Free entry: $V(t) = 0$

$$J(t; w(t)) = C(t) + \frac{c(t)}{q(\theta_t)} - \frac{(1 - \alpha)(w_a(t) - w_r(t))}{r + \phi + s}$$

Model: Workers

- ▶ Value of being unemployed at time t

$$rU(t) = z + \lambda(t) [\alpha W(t; w_r(t)) + (1 - \alpha)W(t; w_a(t)) - U(t)] + E_t \dot{U}(t)$$

- ▶ Value at time t of being employed in a job that pays w

$$rW(t; w) = w - s [W(t; w) - U(t)] + \phi [W(t; w(t)) - W(t; w)] + E_t \dot{W}(t)$$

Model: Wage determination

- ▶ Standard sharing of surplus

$$w(t) = \arg \max [W(t; w) - U(t)]^\beta [J(t; w) - V(t)]^{1-\beta}$$

- ▶ After substituting firm's value functions

$$w_r(t) = \rho(t) + \tilde{\beta}(s + \phi + r)\mu(t) - \tilde{\beta}(1 - \alpha)[w_a(t) - w_r(t)]$$

- ▶ $\rho(t)$ is reservation wage
- ▶ $\tilde{\beta} \equiv \beta/(1 - \beta)$.
- ▶ $\mu(t) = C(t) + c(t)/q(\theta_t)$ is mark-up of newly-negotiated wage over outside options

The reservation wage: Forward-looking

- ▶ Let $\rho^o(t)$ denote the optimal, forward-looking reservation wage, such that $W(t; \rho^o(t)) = U(t)$.
- ▶ Thus:

$$(r + \lambda(t) + s)(\rho^o(t) - z) = E_t \frac{d\rho^o(t)}{dt} + (\lambda(t) - \phi)(w_r(t) - z) + (1 - \alpha)\lambda(t)[w_a(t) - w_r(t)]$$

- ▶ $\rho^o(t)$ depends on average and newly-negotiated wages, labor market conditions, and the expected change in $\rho^o(t)$.
- ▶ In steady-state:

$$\rho^* = z + \frac{\lambda^* - \phi}{r + \lambda^* + s}$$

The reservation wage: Reference-dependence

Deviation of reservation wage $\rho(t)$ from steady state value ρ^* has two components

- ▶ the deviation of the forward-looking reservation wage from steady state value, $\rho^o(t) - \rho^*$
- ▶ the deviation of the reference wage from its steady state value, $w_I(t) - w^*$

$$\rho(t) - \rho^* = \alpha_\rho[\rho^o(t) - \rho^*] + (1 - \alpha_\rho)\alpha_I[w_I(t) - w^*]$$

- ▶ lower α_ρ means stronger reference dependence ($\alpha_\rho = 1$ gives the forward-looking model)
- ▶ lower α_I means less cyclical reference points

Wage cyclicality: Steady state

- ▶ All wages – pre-existing or newly-negotiated – are equal, and reservation wages are equal to their optimal level.
- ▶ Infrequent wage renegotiation, backward-looking wage determination or reference dependence play no role in comparisons of steady-states.
- ▶ Steady-state wage equation:

$$w = z + \tilde{\beta}(r + s + \lambda)\mu$$

- ▶ Given $u = s/(s + \lambda)$:

$$w = z + \tilde{\beta} \left(r + \frac{s}{u} \right) \mu$$

- ▶ Assume acyclical hiring costs, thus mark-up is acyclical.

Wage cyclicality: Steady state

- ▶ Wage-unemployment elasticity:

$$\frac{\partial \ln w}{\partial \ln u} = -\tilde{\beta} \frac{\mu s}{wu} = -(1 - \eta) \frac{s}{ru + s}$$

where $\eta \equiv z/w$ is the replacement ratio.

- ▶ $s/(ru + s)$ close to 1.
- ▶ Thus $\partial \ln w / \partial \ln u \simeq -0.1$ requires $\eta \simeq 0.9$.

[Procyclical mark-up]

- ▶ Mark-up:

$$\mu(t) = \frac{c(t)}{q(t)} + C(t)$$

- ▶ Vacancy duration $1/q(t)$ is procyclical, thus $\mu(t)$ is procyclical as long as the flow cost of keeping an open vacancy is positive ($c(t) > 0$)
- ▶ If vacancy costs are mainly independent of duration (selection, training, etc., Pissarides 2009), $c(t) = 0$ and mark-up is acyclical
- ▶ What about if $c(t) > 0$ and mark-up is procyclical?

$$\frac{\partial \ln w}{\partial \ln u} = -(1 - \eta) \left(\frac{s}{ru + s} - \frac{\partial \ln \mu}{\partial \ln u} \right)$$

- ▶ Procyclicity of hiring costs ($\partial \ln \mu / \partial \ln u < 0$) requires an even higher value of η to match a given wage elasticity.
- ▶ Same argument for procyclical z
(Chodorow-Reich and Karabarbounis 2013)

What is a plausible replacement ratio?

- ▶ z represents the flow utility during unemployment
 - ▶ unemployment compensation
 - ▶ utility of leisure while unemployed
 - ▶ net of job search costs.
- ▶ In 2001, the average proportion of earnings that is maintained when a worker becomes unemployed in the U.K. and Germany was 0.60 and 0.63, respectively (OECD Benefits and Wages)
- ▶ Utility of leisure and search costs hard to measure
- ▶ Krueger and Mueller (2012) report that home production and leisure activities increase during unemployment, but the unemployed enjoy these activities less than the employed

What is a plausible replacement ratio? (II)

- ▶ In steady state:

$$\rho = \frac{r + s + \phi}{r + \lambda + s} z + \frac{\lambda - \phi}{r + \lambda + s} w$$

or:

$$1 - \frac{\rho}{w} = (1 - \eta) \frac{r + \phi + s}{r + \lambda + s}$$

- ▶ In UK data (BHPS) $\rho/w \simeq 0.8$.
- ▶ As typically $\phi < \lambda$, an upper bound for η is 0.8
- ▶ Plausible calibration gives $\eta \simeq 0.69$

Wage cyclicality: Out of steady state

- ▶ With occasional negotiation, wages are expected to persist
- ▶ Thus wages embody expectations about the evolution of labor market conditions
- ▶ Need assumptions about $E_t \lambda(\tau)$
- ▶ e.g. $\lambda(\tau)$ follows a continuous-time AR process, with convergence ξ to steady state λ^*

$$E_t \frac{d\lambda(\tau)}{dt} = -\xi [\lambda(\tau) - \lambda^*]$$

where low values of ξ imply high persistence.

- ▶ Limiting case $\xi \rightarrow \infty$ is equivalent to previous case

Solving the model

- ▶ Model is non-linear in $\lambda(t)$, hence we linearize it around steady-state and derive wage responses to deviations of $\lambda(t)$ from steady-state.
- ▶ These can be related to changes in (the log of) the current unemployment rate, given $u(t) = s/(s + \lambda(t))$.

Note

- ▶ $\lambda(t)$: sufficient statistics for shocks to labor market conditions.
- ▶ A more standard model in which shocks to productivity drive labor market dynamics and $\lambda(t)$ is endogenous gives equivalent results
- ▶ If productivity follows an AR(1) process, $\lambda(t)$ also follows an AR(1) process, which is our assumption

Wage cyclicality results (I)

- ▶ **Newly-negotiated wages, $w_r(t)$**

$$\frac{\partial \ln w_r(t)}{\partial \ln u(t)} = \Gamma_r \frac{\rho^*}{w^*} \frac{\partial \ln \rho(t)}{\partial \ln u(t)}$$

- ▶ **Reservation wages, $\rho(t)$**

$$\frac{\partial \ln \rho(t)}{\partial \ln u(t)} = \left[\left(1 - \frac{w^*}{\rho^*} \right) \frac{\alpha_\rho (\lambda^* + s + \xi)}{r + \lambda^* + s + \xi} + \frac{w^*}{\rho^*} \Gamma_\rho \frac{\partial \ln w_r(t)}{\partial \ln u(t)} \right]$$

- ▶ Even if newly-negotiated wages were completely acyclical – reservation wages would still be cyclical.
- ▶ Without reference dependence ($\alpha_\rho = 1$), predicted elasticity of reservation wage to unemployment is $1 - w^*/\rho^* \simeq -0.25$.
- ▶ Way too high

Wage cyclicality results (II)

- ▶ **Average wages, $w_a(t)$**

$$\frac{\partial \ln w_a(t)}{\partial \ln u(t)} = \frac{\alpha s + \phi}{\alpha s + \phi + \xi} \frac{\partial \ln w_r(t)}{\partial \ln u(t)}$$

- ▶ **Wages in new jobs, $w_n(t)$**

$$\frac{\partial \ln w_n(t)}{\partial \ln u(t)} = \frac{\alpha s + \phi + \alpha \xi}{\alpha s + \phi + \xi} \frac{\partial \ln w_r(t)}{\partial \ln u(t)} = \frac{\alpha s + \phi + \alpha \xi}{\alpha s + \phi} \frac{\partial \ln w_a(t)}{\partial \ln u(t)}$$

- ▶ This implies

$$\frac{\partial \ln w_r(t)}{\partial \ln u(t)} > \frac{\partial \ln w_n(t)}{\partial \ln u(t)} > \frac{\partial \ln w_a(t)}{\partial \ln u(t)}$$

- ▶ But difference in the cyclicality of wages in new job and average wages is small when ξ is small, i.e. unemployment very persistent.

Model parameterization

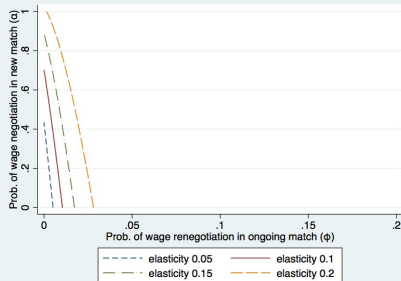
Variable		UK	Ger	Source
Separation rate	s	0.10	0.12	LFS/SOEP
Unempl. rate	u	0.067	0.078	ILO unemp stats
Job finding rate	λ	0.139	0.145	$\lambda = s(1 - u)/u$
Shock persistence	ξ	0.003	0.004	AR(1) estimates
Frequency of negot.	ϕ	0.083	0.083	annual
Interest rate	r	0.003	0.003	standard
Replacement rate	η	0.690	0.754	calibrated on $\rho/w = 0.8$ (BHPS)
Worker barg. power	β	0.05	0.05	Manning (2011, Table 4)

- ▶ s, λ, ξ, r, ϕ expressed in monthly terms
- ▶ No data on:
 - ▶ fraction of matches with newly-negotiated wages (α)
 - ▶ reference dependence ($1 - \alpha_\rho$)
- ▶ Let α and α_ρ vary between 0 and 1.

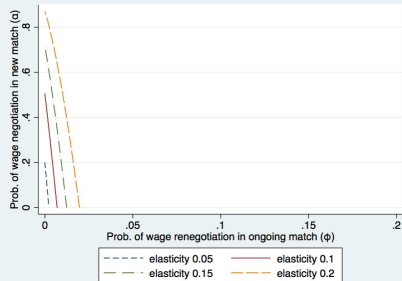
Predictions without reference dependence ($\alpha_\rho = 1$)

- ▶ $\alpha = \phi = 0$ means that wages are never (re)negotiated, either on new or old jobs, thus completely acyclical ($\partial w_a(t)/\partial u(t) = 0$).
- ▶ By continuity there must be combinations $\alpha, \phi > 0$ that deliver mild (realistic) wage cyclicalty
- ▶ Role of α and ϕ , keeping all parameters at benchmark UK values:

Average wage elasticity



Reservation wage elasticity

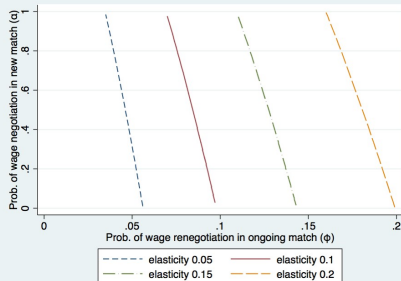


Predictions without reference dependence ($\alpha_\rho = 1$)

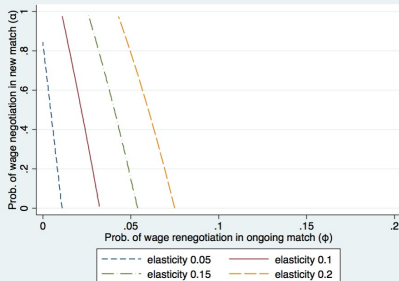
- ▶ Higher unemployment persistence (low ξ) reduces wage cyclicality
- ▶ Role of ξ , keeping all parameters at benchmark UK values:

e.g. set $\xi = 0.1$ (counterfactual), instead of $\xi = 0.003$ (estimated)

Average wage elasticity



Reservation wage elasticity



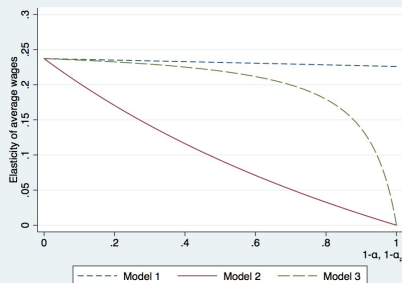
Summary predictions of canonical model

- ▶ Canonical model can only match the observed cyclical nature of wages under either **implausibly long duration of wage contracts** (low ϕ), or **implausibly low unemployment persistence** (high ξ).
- ▶ For given values of ϕ and ξ , the canonical model fares much worse at predicting reservation wage cyclical nature than wage cyclical nature.
- ▶ Clear drawback to solving the wage flexibility puzzle via low ϕ and high ξ is that the canonical model still predicts considerable **“excess” cyclical nature in reservation wages**

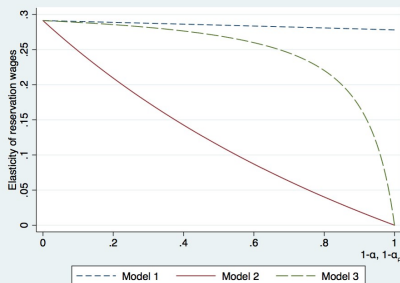
Introduce reference dependence, $\alpha_\rho < 1$

Role of **backward-looking behavior in wage setting** ($1 - \alpha$) vs role of **reference dependence** ($1 - \alpha_\rho$):

Average wage elasticity



Reservation wage elasticity



- ▶ Model 1: No ref dependence ($\alpha_\rho = 1$; running variable is $1 - \alpha$)
- ▶ Model 2: No backward wage setting ($\alpha = 1$; running variable is $1 - \alpha_\rho$) & completely acyclical ref points.
- ▶ Model 3: No backward wage setting ($\alpha = 1$; running variable is $1 - \alpha_\rho$) & ref points as cyclical as average wages.

Summary predictions and road map

- ▶ When reservation wages have a reference-dependent component, the model can produce markedly less-cyclical wages and reservation wages for plausible benchmark parameter values.
- ▶ Without need to alter the wage setting process to make wages more rigid (i.e. can have $\alpha = 1$).
- ▶ Existing evidence has established that wages are only mildly cyclical, but no corresponding evidence for reservation wages.
- ▶ We present evidence on cyclicity of both

Evidence on wage cyclicality

According to the search model wages depend on productivity and outside options, proxied by the unemployment rate

$$\ln w_{iat} = \alpha x_{iat} + \beta \ln u_{at} + d_a + d_t + d_i + \varepsilon_{iat}$$

Issues:

- ▶ Right level of aggregation (local versus national unemployment)
- ▶ All matches versus new matches
- ▶ Several estimates in the literature (Blanchflower Oswald 1994, Gregg Machin Salgado 2014, among others)
- ▶ We estimate wage equation on same data on which we estimate reservation wage equations, and allow for higher elasticity on new matches
- ▶ BHPS (1991-2009) for UK, SOEP (1987-2010) for Germany.

Wage equations for UK

Dependent variable: Log gross hourly wage

	1	2	3	4	5
$\ln u_t$	-0.165*** (0.044)	-0.169*** (0.014)	-0.146*** (0.011)	-0.110*** (0.011)	-0.137*** (0.011)
$\ln u_t * new$			-0.075*** (0.008)	-0.016* (0.009)	
$\ln u_0$ (start)					-0.069*** (0.010)
Trend	t, t^2	t, t^2	t, t^2	t, t^2	t, t^2
Person FE		yes	yes		yes
Job FE				yes	
Obs.	96270	92381	92381	77854	91713

Sample: males and females 18-65; all jobs; 1991-2009.

Wages deflated by CPI. Other controls: gender, quadratic in age, educ (4 groups), cubic in tenure, married, children, region dummies.

s.e. clustered at year level. *** sig at 1%; ** sig at 5%; * sig at 10%

Wage equations for UK - further specifications

Dependent variable: Log gross hourly wage

	1	2	3	4	5
$\ln w_{it-1}$	0.102*** (0.046)				
$\ln u_t$	-0.150*** (0.009)				
$\ln u_{at}$		0.010 (0.010)	-0.053*** (0.007)	-0.044*** (0.006)	-0.042*** (0.006)
$\ln u_{at} * new$				-0.032*** (0.006)	-0.011** (0.006)
trend	t, t^2	no	t, t^2	t, t^2	t, t^2
year dummies	no	yes	no	no	no
person FE	yes	yes	yes	yes	
job FE					yes
Obs.	53054	92380	92380	92380	77854

Sample: males and females 18-65; 1991-2009.

Wages deflated by CPI. Other controls: gender, quadratic in age, educ (4 groups), cubic in tenure, married, children, region dummies.

Col 1: 2-way cluster-robust variance (Cameron and Miller 2013). s.e. clustered at year*reg level in cols 2-5. *** sig at 1%; ** sig at 5%; * sig at 10%

Wage equations: summary

- ▶ UK: wage elasticity to national unemployment between -0.10 and -0.17
- ▶ elasticity to regional unemployment between 0 and -0.05
- ▶ Germany: elasticities lower than for UK and often not significantly different from zero
 - ▶ max -0.065 with national unemployment;
 - ▶ $\simeq 0$ with regional unemployment
- ▶ All below prediction of canonical model without reference points (about -0.25)

Cyclicalty of reservation wages

- ▶ Information on reservation wages in BHPS for everyone out of work, looking for work, and willing to start work
- ▶ Question about:
 - ▶ “lowest take-home pay that one would consider accepting”, and
 - ▶ “expected working hours for such lowest pay”
 - ▶ obtain a measure of hourly net reservation wage
- ▶ Information on reservation wages in SOEP elicited in monthly terms and not supplemented by information on expected hours
 - ▶ Estimate specs for monthly reservation wages, controlling for whether an individual is looking for full-time/part-time job.
- ▶ Covariates in reservation wage equations
 - ▶ all determinants of wages
 - ▶ chances of finding a job (unemployment rate)
 - ▶ utility while unemployed (benefits and household composition)

Quality of reservation wage data

	UK		Germany	
	All	Found job at $t+1$	All	Found job at $t+1$
reservation wage	5.21	4.92	1180	1201
expected wage	5.87	5.62		
post unemp wage		5.43		1302

All wage data are real, net. GBP per hour/EUR per month

- ▶ From reservation wage equations: all human capital indicators and benefits have expected impact on reservation wages
- ▶ Correlation between reservation wages and
 - ▶ remaining unemployment duration;
 - ▶ post-unemployment wages

is in line with model predictions

Quality of UK reservation wage data

	Whether found job at $t + 1$			Post-unemp wage		
	1	2	3	4	5	6
$\ln \rho_t$	0.001 (0.008)	-0.020** (0.008)	-0.020* (0.011)	0.436*** (0.021)	0.312*** (0.036)	0.157*** (0.080)
year effects	yes	no	no	yes	no	no
trend	no	t, t^2	t, t^2	no	t, t^2	t, t^2
controls	no	yes	yes	no	yes	yes
person FE	no	no	yes	no	yes	yes
Obs.	15278	14701	10642	2685	2594	2602

Sample: (1)-(3): nonemployed males and females 18-65; (4)-(6) with nonmissing wages at $t + 1$, 1991-2009. Controls: gender, quadratic in age, educ (4 groups), cubic in duration, married, children, log benefits, region dummies. *** sig at 1%; ** sig at 5%; * sig at 10%.

Quality of German reservation wage data

	Whether found job at $t + 1$			Post-unemp wage		
	1	2	3	4	5	6
$\ln \rho_t$	0.033 ^{***} (0.007)	-0.081 ^{***} (0.011)	-0.100 ^{***} (0.016)	0.737 ^{***} (0.023)	0.391 ^{***} (0.034)	0.123 (0.106)
year effects	yes	no	no	yes	no	no
trend	no	t, t^2	t, t^2	no	t, t^2	t, t^2
controls	no	yes	yes	no	yes	yes
person FE	no	no	yes	no	yes	yes
Obs.	11534	11534	8156	2984	2984	755

Sample: (1)-(3): nonemployed males and females 18-65; (4)-(6) with nonmissing wages at $t + 1$, 1988-2010. Controls: gender, quadratic in age, educ (4 groups), cubic in duration, married, children, log benefits, region dummies. *** sig at 1%; ** sig at 5%; * sig at 10%.

Reservation wage equations for the UK

Dep var: log hourly reserv. wage		
	1	2
$\ln u_t$	-0.175 ^{***} (0.058)	-0.146 ^{**} (0.042)
trend	t, t^2	t, t^2
person FE	no	yes
Obs.	14874	10774

Sample: nonemployed males and females 18-65; 1991-2009. Dep var: log real hourly reservation wage. Other controls: gender, quadratic in age, educ (4 groups), cubic in duration, married, children, log benefits, region dummies. s.e. clustered at the year level (cols 1-4); year*reg (col 5). Col 6: 2-way cluster-robust variance (Cameron and Miller 2013). *** sig at 1%; ** sig at 5%; * sig at 10%.

Reservation wage equations for the Germany

Dep var: log hourly reserv. wage		
	1	2
$\ln u_t$	0.001 (0.065)	0.038 (0.054)
trend	t, t^2	t, t^2
person FE	no	yes
Obs.	11221	7911

Sample: nonemployed males and females 18-65; 1987-2009. Dep var: log real hourly reservation wage. Other controls: gender, quadratic in age, educ (4 groups), cubic in duration, married, children, log benefits, region dummies. s.e. clustered at the year level (cols 1-4); year*reg (col 5). Col 6: 2-way cluster-robust variance (Cameron and Miller 2013). *** sig at 1%; ** sig at 5%; * sig at 10%.

Reservation wage equations: summary

- ▶ Elasticity of reservation wages to unemployment about -0.15 in UK; and about 0 in Germany (-0.08 when using lag unemployment)
- ▶ These estimates are not consistent with the canonical model ($\alpha_\rho = 1$) for two reasons
 1. canonical model predicts elasticity $\simeq -0.30$
 2. canonical model predicts that reservation wages should be more cyclical than wages
- ▶ A model element that would reduce the cyclical of reservation wages would bring predictions closer to their empirical counterparts

Reference dependence in job search

- ▶ Reference dependence in job search generates lower cyclicity than the canonical model as long as ref points less cyclical than forward looking variables (eg arrival rate of job offers)
- ▶ eg: past employment history or reference groups may deliver perceptions of “fair wage” that are not too sensitive to current economic conditions
- ▶ Implication: due to sticky reference point, reservation wages do not fall as much in recession

Reference points in our context

- ▶ If past wages shape reference points, which in turn influence reservation wages, we should expect a significant correlation between past wages and reservation wages.
- ▶ But several confounding factors in such correlation
- ▶ Direct links (if any) between UI benefits and past wages, and UI is key component of reservation wages in the canonical model.
 - ▶ this is the case for Germany - UI entitlement is function of previous social security contribution and thus past wages
 - ▶ but not for UK: eg JSA is currently \$57.35 for 16-24; \$72.40 for 25+; with some allowance for dependants.
 - ▶ no explicit reference to previous earnings in UK
- ▶ Unobserved productivity components of past wages, reflected into reservation wages in the canonical model via the wage offer distribution.

Approach

- ▶ Aim to isolate the **rent component** of past wages and observe its correlation with current reservation wages
- ▶ If job search is forward-looking (canonical model), past rents should not be relevant for reservation wages.
- ▶ If job search is reference-dependent, past rents feature in reservation wages – as long as they represent a meaningful benchmark.

Identification of reference points

- ▶ Empirical reservation wage model:

$$\ln \rho_{it} = \beta_1 X_{it} + \beta_2 \ln w_{it-d_i} + \varepsilon_{it}$$

where w_{it-d_i} is wage in last job held, lost d_i years ago

- ▶ w_{it-d_i} includes components of both worker ability (w_i^*) and rents (R_{it-d_i}):

$$\ln w_{it-d_i} = \gamma_1 X_{it-d_i} + \gamma_2 R_{it-d_i} + w_i^* + u_{it-d_i}$$

- ▶ Identification of reference point effect requires a proxy for past rents, which is orthogonal to worker ability.

Proxy for rents

- ▶ Use industry affiliation as a proxy for the size of rents in a job
 - ▶ long-established literature (eg Krueger and Summers 1988)
- ▶ Use predicted industry-level wage - having controlled for (un)observables - as an instrument for previous wages in the reservation wage equation
- ▶ Exclusion restriction requires no wealth effects from previous wages
 - ▶ not much in sample used
 - ▶ but include controls for assets (home ownership and bank accounts)

Steps

- ▶ Estimate log wage regression for 1982-2009 on ASHE, controlling for 4-digit industry effects, unrestricted age effects, region, year, individual FE.
- ▶ Obtain industry-specific rent $\widehat{\ln w_j}$ for $j = 4$ -digit industries
- ▶ Use $\widehat{\ln w_j}$ as IV for $\ln w_{it-d_i}$ in reservation wage equation.
- ▶ On BHPS, for each unemployed i at t : observed in employment d_i years ago, in industry j , earning wage w_{it-d_i} .

Results: Reservation wages and rents - OLS

Dep var: log hourly reservation wage			
	1	2	3
$\ln w_{it-d}$	0.083*** (0.005)	0.033*** (0.010)	0.042*** (0.011)
$\ln w_{it-d} * d$			-0.011* (0.006)
$\ln u_t$	-0.183*** (0.081)	-0.173*** (0.075)	-0.174*** (0.075)
person FE	no	yes	yes
Obs.	8091	5737	5737

Results: Reservation wages and rents - IV

Dep var: log hourly reservation wage			
	1	2	3
$\ln w_{it-d}$	0.133*** (0.018)	0.149*** (0.063)	0.153*** (0.067)
$\ln w_{it-d} * d$			-0.002 (0.009)
$\ln u_t$	-0.159* (0.084)	-0.177** (0.067)	-0.166* (0.078)
person FE	no	yes	yes
Obs.	7732	5520	5520
F -stat ¹	908.9	53.7	53.7
F -stat ²			64.2

IV in cols 1-2: predicted 4-digit industry wage differential. IV in col 3: predicted 4-digit industry wage differential, and its interaction with time since job loss.

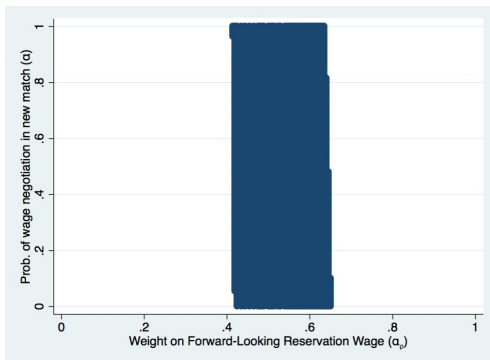
Quantitative predictions

- ▶ Backward looking behavior in wage setting represented by α
- ▶ Backward looking behavior in reservation wages summarized by α_ρ and α_I :

$$\rho(t) - \rho^* = \alpha_\rho[\rho^o(t) - \rho^*] + (1 - \alpha_\rho)\alpha_I[w_I(t) - w^*]$$

- ▶ Is there a triple of parameter values $(\alpha, \alpha_\rho, \alpha_I)$, that yields quantitative predictions close to empirical findings?
- ▶ Use data moments:
 - ▶ coefficient on lagged wages (IV) in reservation wages: 0.15
 - ▶ elasticity of wages to unemployment: -0.17
 - ▶ elasticity of reservation wages to unemployment: -0.15
- ▶ Thus
 - ▶ $(1 - \alpha_\rho)\alpha_I = 0.15$
 - ▶ select combinations of (α, α_ρ) that yield elasticities of wages and reservation wages within 0.02 of 0.17 and -0.15 , respectively.

Model fit



- ▶ only values of α_ρ in the range 0.40-0.65 meet the above criteria
- ▶ once α_ρ lies in this range, almost any value of α meets the criteria
- ▶ Model in which between 35% and 60% of variation in reservation wages is driven by backward-looking ref points matches cyclicity of average wages and reservation wages

Conclusions

- ▶ (lack of) Wage cyclicality is an enduring puzzle in labor and macroeconomics
- ▶ We propose a matching model with infrequent wage negotiation which delivers reduced-form predictions for elasticity of wages to unemployment
- ▶ Under plausible assumptions, the reservation wage is the main cyclical component of wages
- ▶ Failure of canonical model to match actual (reservation) wage elasticity calls for alternative reservation wage model - rather than alternative wage setting models
- ▶ Reference dependence in reservation wages, of which we find evidence, generates less cyclical reservation wages and wages
- ▶ This is sufficient to reconcile theoretical predictions with empirical estimates of wage cyclicality