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 cyclicality 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
  - Shimer puzzle can be rephrased as "why are wages sticky?", i.e. "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 cyclicality 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 neoclassical – 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 (high value of nonmarket time, 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 cyclicality of wages and reservation wages
   - Canonical model predicts elasticity of wages and reservation wages to unemployment 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), which can be obtained from Nash bargaining in search model, but is also consistent with alternative wage setting models, and can be easily estimated
- does not require to estimate a relationship between productivity shocks and unemployment.
- Equilibrium (reservation) wages depend on current and future expected labour market conditions, treated as exogenous.
  - Shocks only affect wages and reservation wages via arrival rate of job offers (sufficient stat for labor market conditions) and further structure on their source and form is not needed.

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 cyclicality.

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, $J(t; w)$

$$\begin{aligned} rJ(t; w) &= p(t) - w - s\left[J(t; w) - V(t)\right] + \phi\left[J(t; w_r(t)) - J(t; w)\right] \\ &\quad + E_t \dot{J}(t) \end{aligned}$$

- 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

$$\begin{aligned} rU(t) &= z + \lambda(t)\left[\alpha W(t; w_r(t)) + (1-\alpha) W(t; w_a(t)) - U(t)\right] \\ &\quad + E_t \dot{U}(t) \end{aligned}$$

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

$$\begin{aligned} rW(t; w) &= w - s\left[W(t; w) - U(t)\right] + \phi\left[W(t; w(t)) - W(t; w)\right] \\ &\quad + E_t \dot{W}(t) \end{aligned}$$

Model: Wage determination

- Standard sharing of surplus

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

- After substituting firm's value functions

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

- $\rho(t)$ is reservation wage
- $\widetilde{\beta} \equiv \beta/(1-\beta)$.
- $\mu(t) = C(t) + c(t)/q(\theta_t)$ 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:

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

- $\rho^o(t)$ 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, $w_l(t) - w^*$
- Thus

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

- lower α_ρ means stronger reference dependence ($\alpha_\rho = 1$ gives the forward-looking model)
- lower α_l 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:

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

- Given $u = s/(s + \lambda)$:

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

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

Wage cyclicality: Steady state

- Wage-unemployment elasticity:

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

  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?

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

- Procyclicality 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^*

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

  where low values of ξ imply high persistence.
- Limiting case $\xi \to 0$ 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 $u(t) = s/(s + \lambda(t))$.

Wage cyclicality results (I)

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

$$\frac{\partial \ln w_r(t)}{\partial \ln u(t)} = \Gamma_r \left[\frac{\rho^*}{w^*} \frac{\partial \ln \rho(t)}{\partial \ln u(t)} + \left(1 - \frac{\rho^*}{w^*}\right) \frac{\partial \ln \mu(t)}{\partial \ln u(t)} \right]$$

- **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

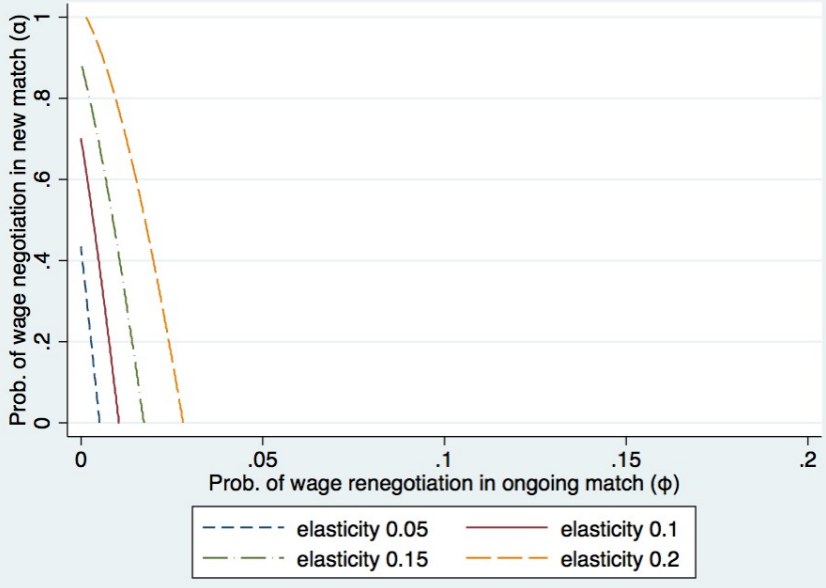
Variable		UK	Ger	Source
Separation rate	s	0.10	0.12	LFS/SOEP
Unempl. rate	u	0.067	0.078	ILO unemp stats
Job finding rate	λ	0.139	0.145	$\lambda = s(1-u)/u$
Shock persistence	ξ	0.003	0.004	AR(1) estimates
Frequency of negot.	ϕ	0.083	0.083	annual
Interest rate	r	0.003	0.003	standard
Replacement rate	η	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 cyclicality
- Role of α and ϕ, keeping all parameters at benchmark UK values:

Average wage elasticity



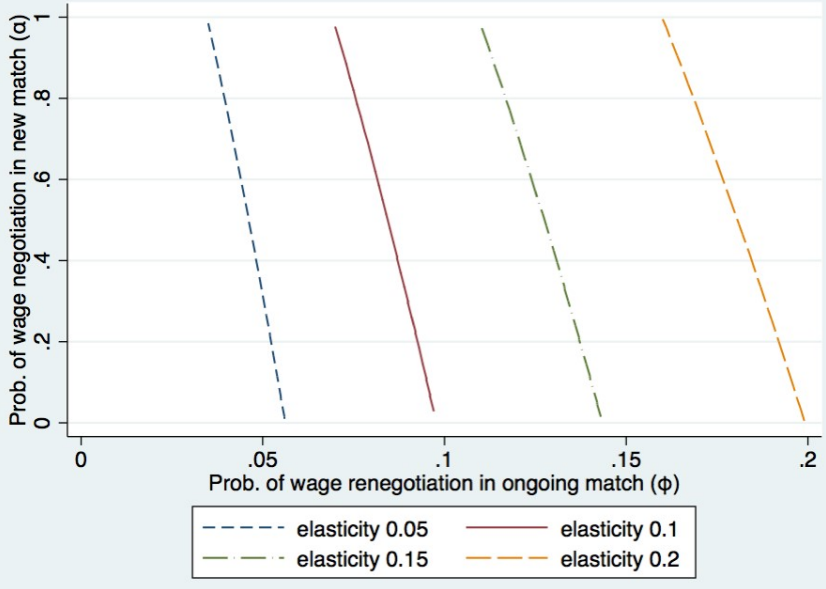
Reservation wage elasticity

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

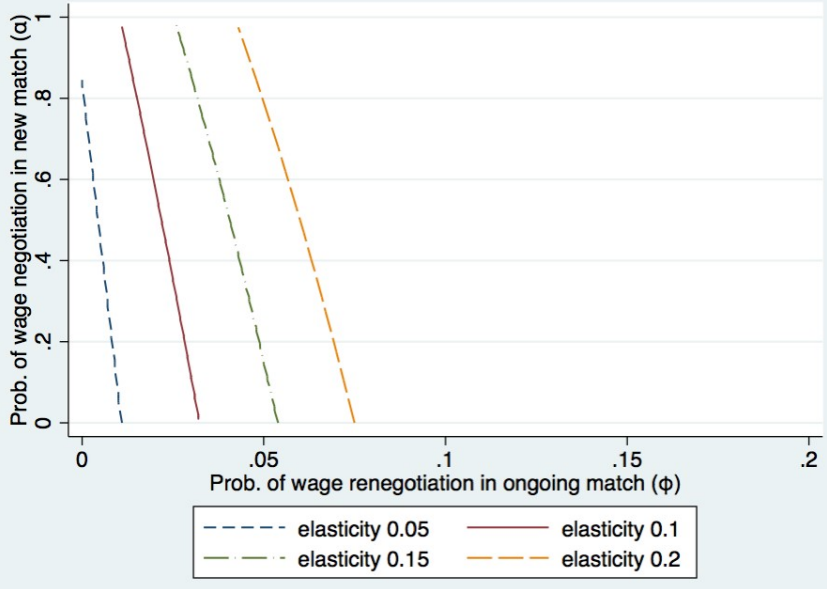
- Higher unemployment persistence (low ξ) reduces wage cyclicality
- Role of ξ, keeping all parameters at benchmark UK values:

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

Average wage elasticity



Reservation wage elasticity



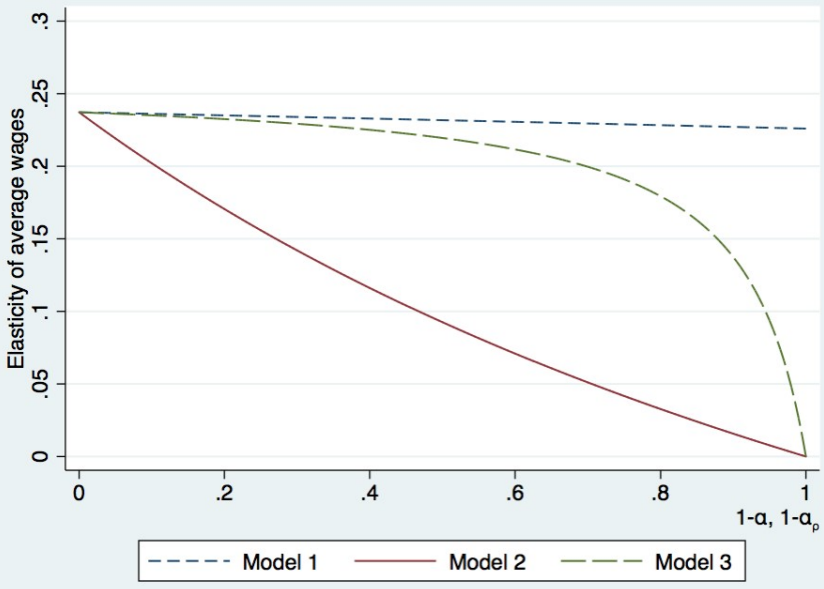
Summary predictions of canonical model

- Canonical model can only match the observed cyclicality 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 cyclicality than wage cyclicality.
- Clear drawback to solving the wage flexibility puzzle via low ϕ and high ξ is that the canonical model still predicts considerable **"excess" cyclicality in reservation wages**

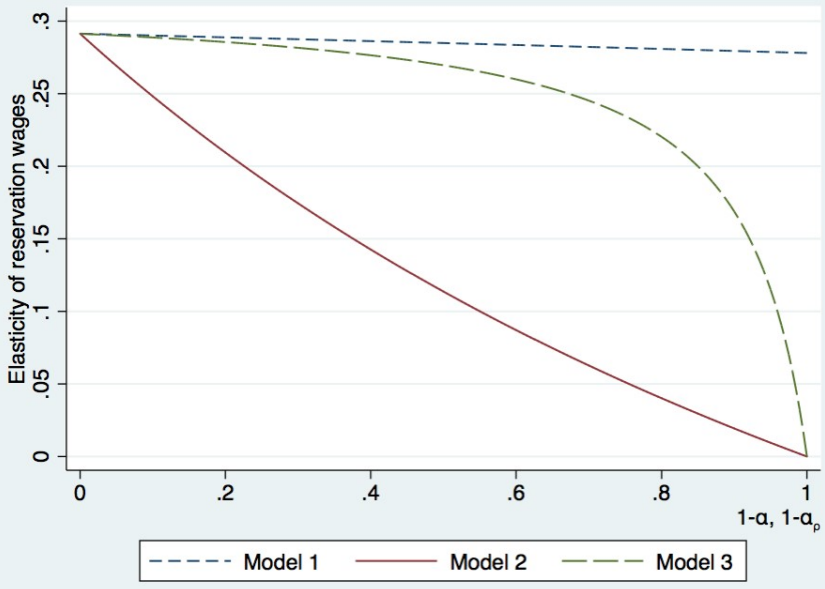
Introduce reference dependence, $\alpha_\rho < 1$

- 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 2: 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 cyclicality 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	$-\mathbf{0.165}^{***}$	$-\mathbf{0.169}^{***}$	$-\mathbf{0.146}^{***}$	$-\mathbf{0.110}^{***}$	$-\mathbf{0.137}^{***}$
	(0.044)	(0.014)	(0.011)	(0.011)	(0.011)
ln $u_t * new$			$-\mathbf{0.075}^{***}$	$-\mathbf{0.016}^{*}$	
			(0.008)	(0.009)	
ln u_0 (start)					$-\mathbf{0.069}^{***}$
					(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	$\mathbf{-0.150}^{***}$				
	(0.009)				
ln u_{at}		$\mathbf{0.010}$	$\mathbf{-0.053}^{***}$	$\mathbf{-0.044}^{***}$	$\mathbf{-0.042}^{***}$
		(0.010)	(0.007)	(0.006)	(0.006)
ln $u_{at} * new$				$\mathbf{-0.032}^{***}$	$\mathbf{-0.011}^{**}$
				(0.006)	(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 (about -0.25)

Cyclicality 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 specifications for monthly reservation wages, controlling for whether an individual is looking for a full-time, part-time, or any job.
- Covariates in reservation wage equations
  - all determinants of wages
  - chances of finding a job (unemployment rate)
  - utility while unemployed (total 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**	**−0.020****	**−0.020***	**0.436*****	**0.312*****	**0.157*****
	(0.008)	(0.008)	(0.011)	(0.021)	(0.036)	(0.080)
year dummies	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%.

Reservation wage equations for the UK

Dep var: log hourly reserv. wage		
	1	2
ln u_t	$\mathbf{-0.175}^{***}$	$\mathbf{-0.146}^{**}$
	(0.058)	(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: 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 cyclicality of reservation wages would bring predictions closer to their empirical counterparts

Reference dependence in job search

- Reference dependence in job search generates lower cyclicality 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 wage w_{it-d_i}.

Results: Reservation wages and rents - OLS

Dep var: log hourly reservation wage			
	1	2	3
ln w_{it-d}	$\mathbf{0.083}^{***}$	$\mathbf{0.033}^{***}$	$\mathbf{0.042}^{***}$
	(0.005)	(0.010)	(0.011)
ln $w_{it-d} * d$			$-\mathbf{0.011}^{*}$
			(0.006)
ln u_t	-0.183^{***}	-0.173^{***}	-0.174^{***}
	(0.081)	(0.075)	(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}	$\mathbf{0.133}^{***}$	$\mathbf{0.149}^{***}$	$\mathbf{0.153}^{***}$
	(0.018)	(0.063)	(0.067)
ln $w_{it-d} * d$			$\mathbf{-0.002}$
			(0.009)
ln u_t	-0.159^{*}	-0.177^{**}	-0.166^{*}
	(0.084)	(0.067)	(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.

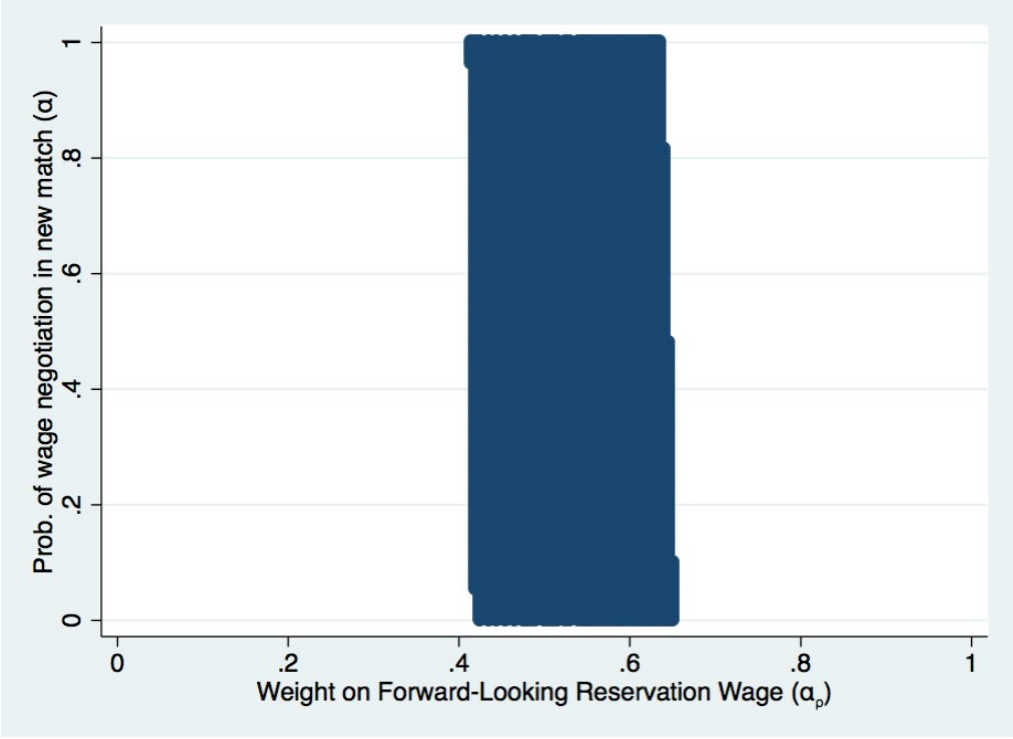
Quantitative predictions

- 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 cyclicality 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