Understanding Fluctuations in the Ins and Outs of the Labor Force

Etienne Lalé

University of Bristol

May 2014

Motivation

- Recent research emphasizes the importance of movements into (*the ins*) and out (*the outs*) of the labor force:
  - Over the business cycle: considerable levels of volatility
  - Over the long run: differences in employment across countries
  - Over the life-cycle: distribution of participation and unemployment spells
- As a matter of theory, it is unclear whether those should be procyclical or countercyclical in a job-search model
- Relevance for policy analysis has been well illustrated by the recent recession (e.g. UI extensions enacted in 2008-2010)

This paper

- Analyze the contribution of two economic forces to the cyclical behavior of worker flows into (*the ins*) and out (*the outs*) of the labor force:
  - Changes in labor force attachment
  - Changes in job availability

- Structural approach: a partial equilibrium job search model
  - Operationalize the notion of labor force attachment: combination of different returns to market and home production activities
  - Identify workers' response to (exogenous) changes in job availability

- Model maps wage data from the CPS and job creation and destruction rates from the JOLTS onto worker flows across all three labor market states

Main results

1. Cross-sectional heterogeneity in labor force attachment matters for explaining the ins and outs on average over the cycle

2. Labor force attachment exhibits little volatility at business cycle frequency; fluctuations in the ins and outs are mainly driven by job availability

3. The negative correlation between labor force attachment and job availability accounts for some counter-intuitive movements in the ins and outs

Related literature

- Theoretical literature on dynamic, frictional models of the labor market with three states: Garibaldi & Wasmer [JEEA '05]; Krusell et al. [JET '11; NBER '13]; Pries & Rogerson [EER '09]; Shimer [AEE '13]

- Empirical literature on worker flows:
  - Broad empirical literature on stock-flow equations: Petrongolo & Pissarides [AER '08]; Elsby et al. [REStat '13; '13]; Shimer [RED '12]
  - Composition effects/"heterogeneity hypothesis" of Darby et al. [NBER '86]; Baker [AER '92]; Elsby et al. ['13]; Mueller ['12]

- Minor note: build on a correction strategy proposed by Elsby et al. ['13] to address classification error in reported labor force status in the CPS
  - Update the estimates of gross worker flows in the U.S.
  - Provide evidence of cyclicality in measurement error

Outline

U.S. labor market facts

A job-search model

Specification and estimation

Quantitative results

I. U.S. labor market facts

The ins and outs over time

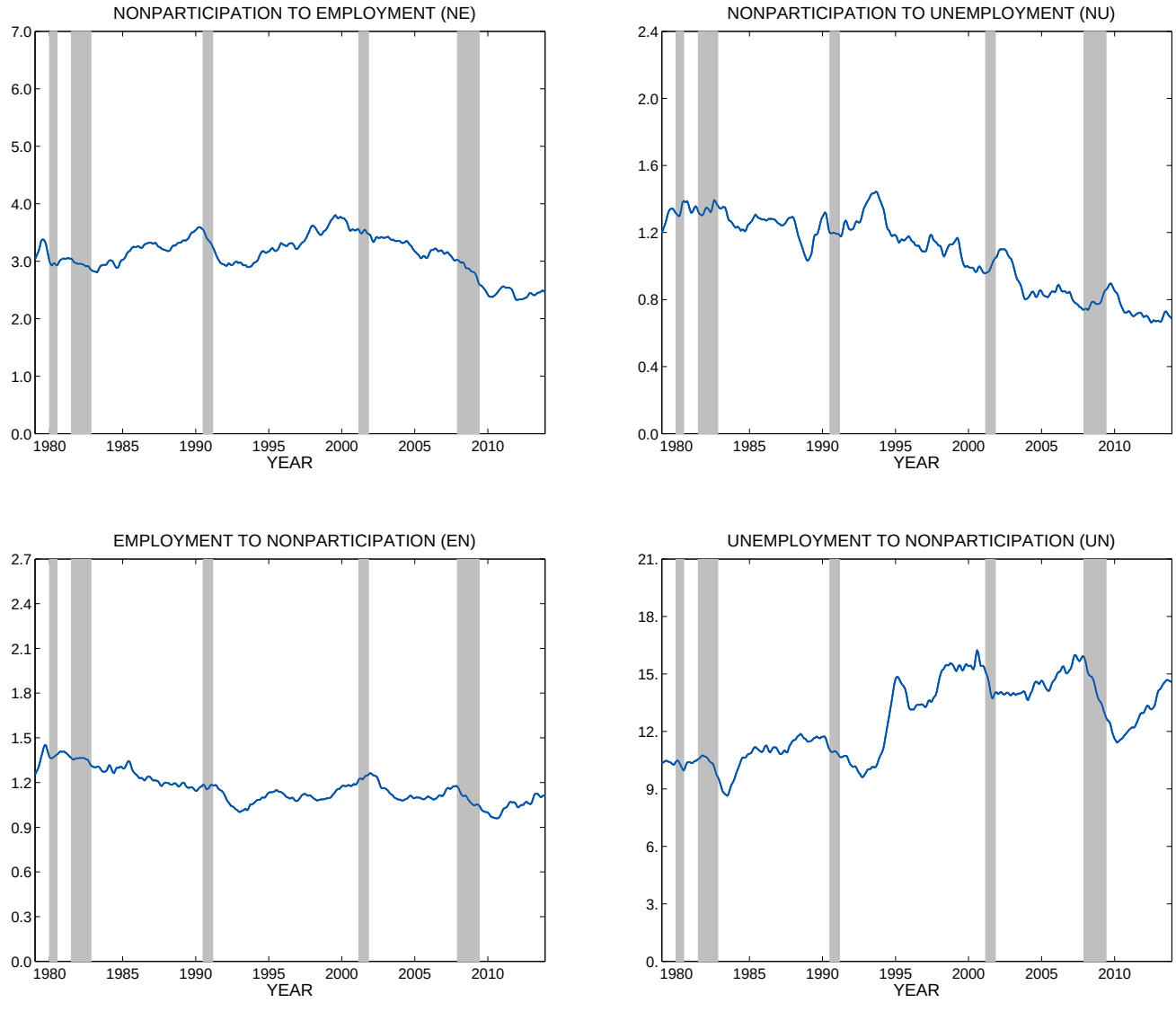

Figure 1: The ins and outs of the labor force (Monthly transition probabilities)

The ins and outs over time

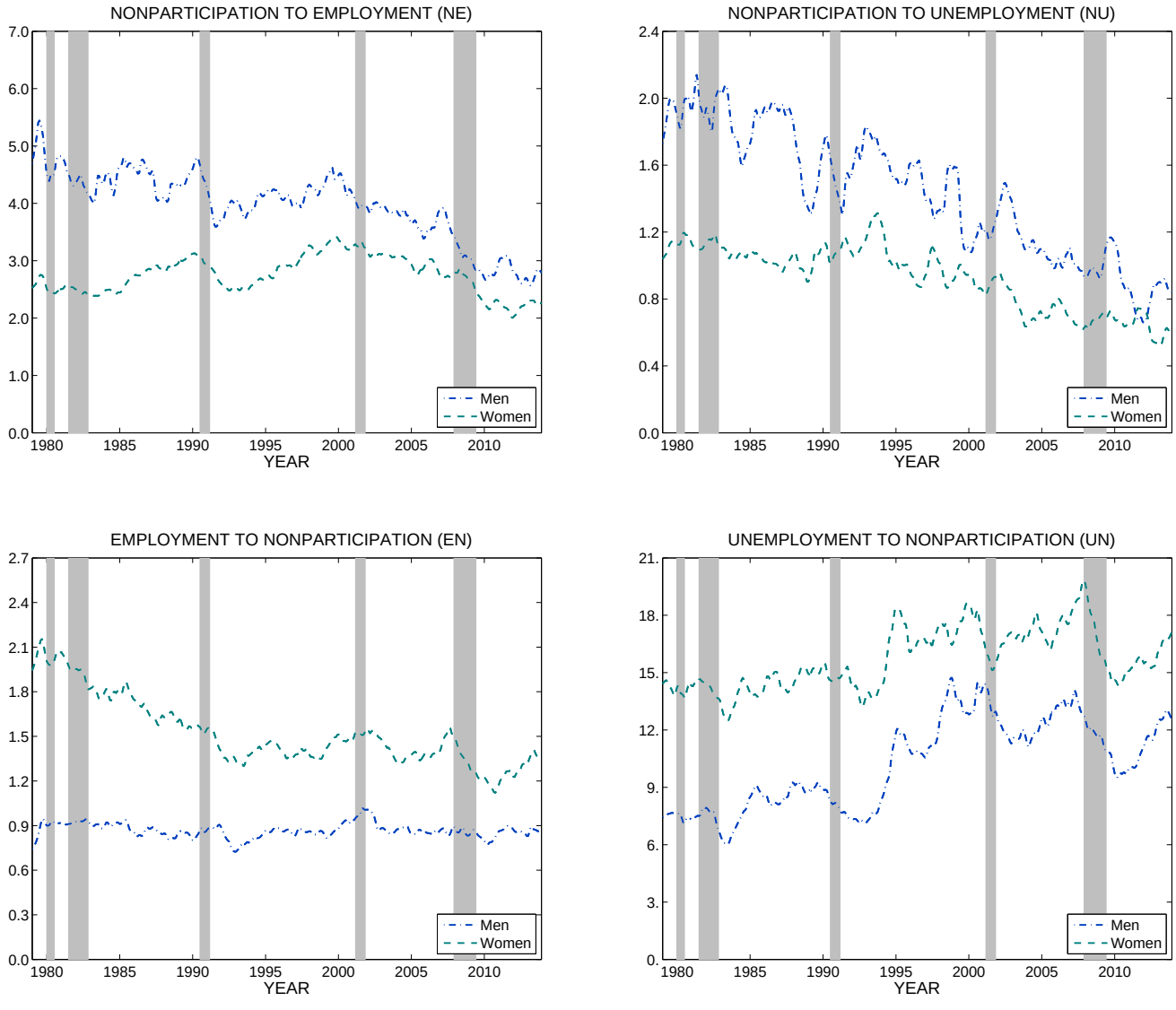

Figure 2: The ins and outs, by gender (Monthly transition probabilities)

U.S. labor market facts

Table 1: Worker flows in the United States: business cycle facts

	Flows						Stocks	
x	E-U	E-N	U-E	U-N	N-E	N-U	U/(E+U)	E+U
$\mathbb{C}\text{orr}\,(x, x_{-1})$	0.980	0.943	0.992	0.985	0.937	0.944	0.990	0.942
$\sigma(x)/\sigma(u)$	0.427	0.303	0.649	0.493	0.372	0.385	-	0.035
$\mathbb{C}\text{orr}\,(x, u)$	0.827	-0.280	-0.879	-0.803	-0.711	0.422	-	-0.503

NOTE: E: employment; U: unemployment; N: nonparticipation; u and $\frac{U}{E+U}$: unemployment rate; $E+U$: participation rate.

Worker flows are monthly transition probabilities computed over the years 1979 to 2013; these series are MA smoothed. Worker stocks are the seasonally-adjusted monthly series from the BLS.

All time-series are taken in log as deviation from an HP trend with smoothing parameter $3.0^{4.75} \times 10^5$. The standard deviation of the unemployment rate over the period is 0.185.

II. A job-search model

Economic environment

I. Individuals

- Measure one, infinitely-lived
- Preferences:

$$\mathbb{E}_0 \sum_{t=0}^{+\infty} \beta^t \left(c_t - a n_t \right)$$

II. Labor force attachment

- $n \in \{0,1\}$ is participation in the labor force ; a measures the opportunity cost
- Each worker is endowed with her own idiosyncratic return to market activity w
- w evolves over time according to

$$w_{t+1} = f\left(w_t, \varepsilon_{t+1}^w, u_{t+1}^C\right)$$

III. Job availability

- Three "islands": employment (E), unemployment (U) and nonparticipation (N)
- State-specific probability of getting a work opportunity

$$\lambda_{i,t},\ i \in \{E,U,N\},\ t \in \mathbb{N}$$

Simple version

Bellman equations

Three asset values $(N(.), U(.), E(.))$; jointly determined by:

$$N(w) = \beta \int \left(\lambda_N \max\left\{E\left(w'\right), O\left(w'\right)\right\} + (1-\lambda_N) O\left(w'\right)\right) dF\left(w'|w\right)$$

$$U(w) = -a + \beta \int \left(\lambda_U \max\left\{E\left(w'\right), O\left(w'\right)\right\} + (1-\lambda_U) O\left(w'\right)\right) dF\left(w'|w\right)$$

$$E(w) = w - a + \beta \int \left(\lambda_E \max\left\{E\left(w'\right), O\left(w'\right)\right\} + (1-\lambda_E) O\left(w'\right)\right) dF\left(w'|w\right)$$

where

$$O(w) = \max\{U(w), N(w)\}$$

Key decisions

- Working vs. Not working: $E(w)$ v.s. $O(w)$
- Participating vs. Not participating: $U(w)$ v.s. $N(w)$

Simple version

Definition: A *search equilibrium* is:

(i) A list of value functions $(N(.), U(.), E(.))$

(ii) Two thresholds w_W^* and w_P^* for work and participation decisions, respectively

(iii) A time-invariant distribution of workers $(\mu_N(.), \mu_U(.), \mu_E(.))$

Proposition: A search equilibrium has the following properties:

(i) Under the assumption that $\lambda_E > \lambda_U > \lambda_N$, an equilibrium exists and is unique

(ii) Provided w is sufficiently persistent, $w_P^* \geq w_W^*$. As a result, workers flows between employment and unemployment are caused by frictions only

(iii) Depending on a, an equilibrium is either a "pure participation" equilibrium or a "mixed equilibrium" with worker flows across all three labor market states

[Proof of (i) provides a method for computing a search equilibrium]

Extended version

Sources of cross-sectional heterogeneity:

- Opportunity cost of participation a is heterogenous in the cross-section; hence there is a continuum of reservation wages for work and participation
- Employed workers who lose their job $(1 - \lambda_E)$ collect UI benefits conditional on staying in the labor force; UI benefits have finite duration (exhaustion rate ϕ)

Sources of business-cycle fluctuations:

- The aggregate state of the economy consists of three objects

$$u_t^C \; ; \; \delta_t \; ; \; \lambda_t$$

- [Expectations depend on the aggregate state vector]

III. Specification and estimation

Specification based on CPS data

$$\log(w_{t+1}) = \gamma u^C_{t+1} + \rho \log(w_t) + \varepsilon^w_{t+1}$$

Parameter estimated on wages from the CPS

- γ: semi-elasticity of wages w.r.t. cyclical component of unemployment
- ρ and σ_ε are estimated using the limited longitudinal dimension of the survey

Making sense of self-selection in the data

- Heckman procedure yields a smaller persistence and greater heterogeneity in w
- This is consistent with truncation of low values of w
- Specify heterogeneity in leisure utility as $a \sim \mathscr{B}(\alpha_1, \alpha_2)$

[Parameters of the wage process are estimated using Heckman's selection model]

Specification based on JOLTS data

$$\lambda_{E,t} = 1 - s_E \delta_t \ ; \ \lambda_{U,t} = s_U \lambda_t \ ; \ \lambda_{N,t} = s_N \lambda_t$$

Estimated process for job-finding and job-destruction rates

$$\begin{array}{rcl} \delta_{t+1} & = & 0.01714 + 0.97661 \times \delta_t + 0.00021 \times \varepsilon^{\delta}_{t+1} \ ; \ R^2 = 0.947 \\ & & (0.00041) \ \ (0.00948) \qquad (0.00001) \end{array}$$

$$\begin{array}{rcl} \lambda_{t+1} & = & 0.33299 - 2.91244 \times \delta_t + 0.99296 \times \lambda_t + 0.00458 \times \varepsilon^{\lambda}_{t+1} \ ; \ R^2 = 0.988 \\ & & (0.03844) \ \ (0.96152) \qquad (0.00522) \qquad (0.00014) \end{array}$$

Making business cycle conditions enter workers' expectations

- Discretize law of motion for (δ_t, λ_t)
- Workers use $\frac{\delta_t}{\delta_t + \lambda_t}$ to approximate u_t $(R^2 = 0.852)$

Estimation/Calibration

Parameters set exogenously:

β	b	ϕ	ρ	σ_ε	γ
0.9967	0.40	0.167	0.947	0.239	-0.606

Calibration procedure for $(s_E, s_U, s_N, \alpha_1, \alpha_2)$:

- Simulate a long series ($T = 5,000$) for (δ_t, λ_t)
- 8 empirical moments, 2 of which are redundant
- [Target 1st moments only, not business cycle moments]

α_1	α_2	s_E	s_U	s_N
5.975	1.110	0.984	1.001	0.202

IV. Quantitative results

Fit of main series

Table 2: Worker flows in the model and in the data: overall fit

	Flows						Stocks	
x	E-U	E-N	U-E	U-N	N-E	N-U	U/(E+U)	E+U
				(a) Data				
$\bar{x}$	1.17	1.16	26.3	12.6	3.11	1.08	6.67	72.2
				(b) Model				
$\bar{x}$	1.56	2.12	29.4	11.4	3.36	3.52	8.31	71.5
$\mathbb{C}\text{orr}\left(x, x_{-1}\right)$	0.986	0.840	0.988	0.821	0.979	0.879	0.994	0.985
$\sigma(x)/\sigma(u)$	0.971	0.746	1.036	0.270	0.757	0.499	1.000	0.064
$\mathbb{C}\text{orr}\left(x, u\right)$	0.529	-0.434	-0.753	-0.356	-0.696	0.721	1.000	-0.661

NOTE: E: employment; U: unemployment; N: nonparticipation.
$\bar{x}$ show the mean of levels ($\times 10^2$); Moments were computed from a simulation of 5,000 model periods.
Worker flows in the data are the monthly probabilities displayed in the first panel of table 1.

Model outcomes

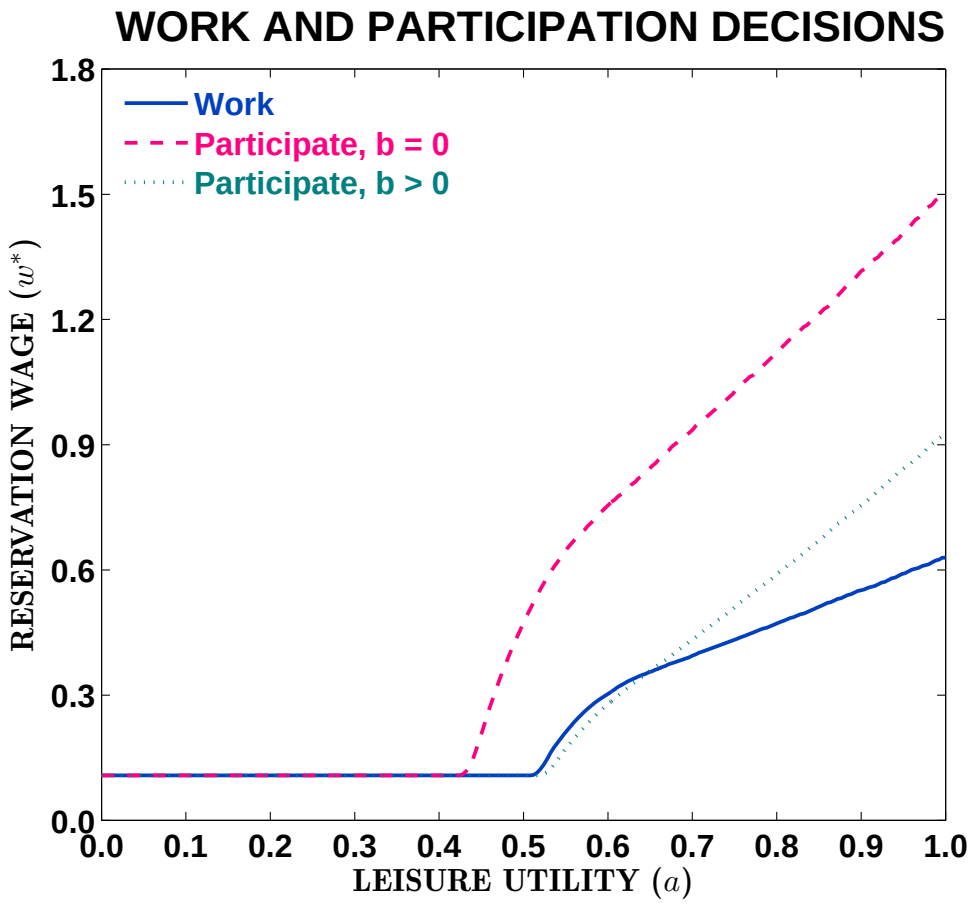

Figure 3: Heterogeneity in returns to home production activities: Policy functions

Model outcomes

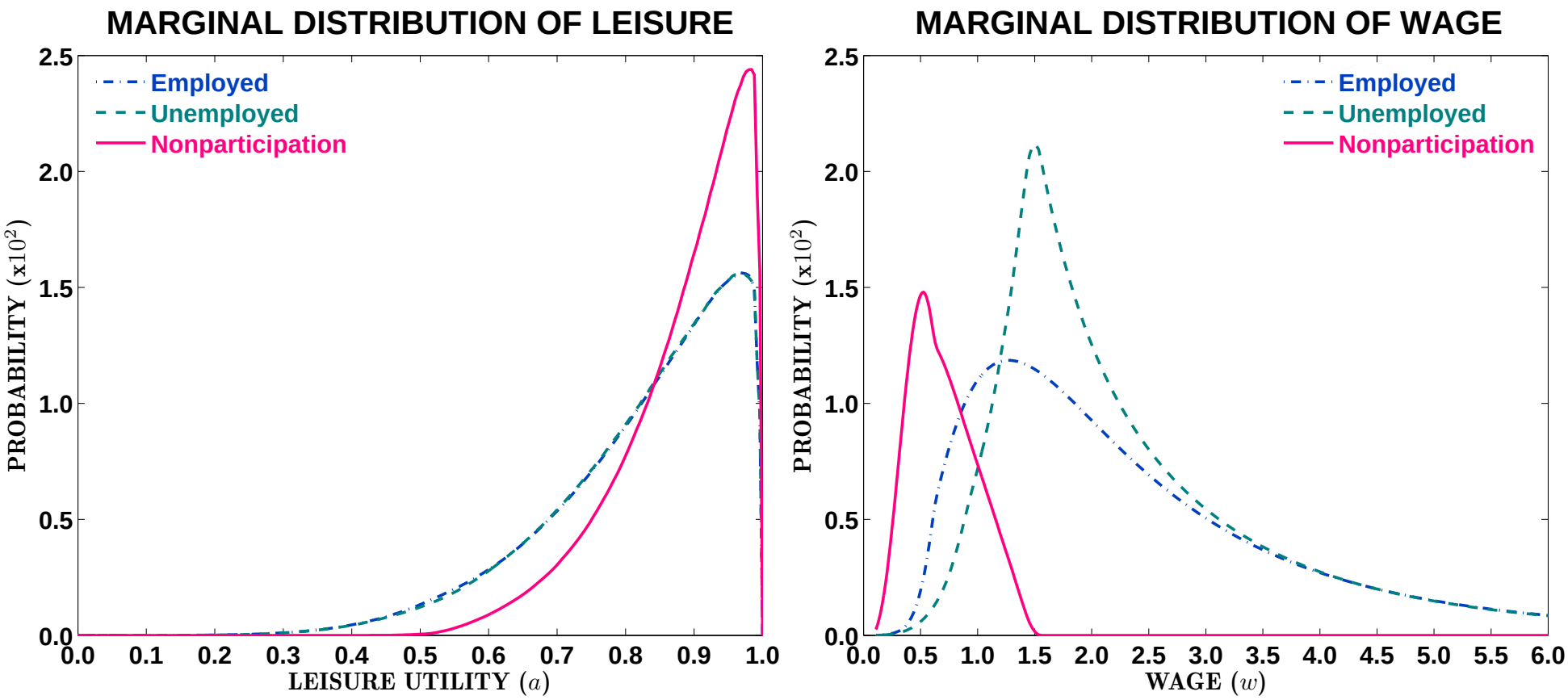

Figure 4: Heterogeneity in returns to market and home production: Marginal distributions

Model outcomes

Table 3: Worker flows in the model: role of cross-sectional aggregation

	Flows						Stocks	
	E-U	E-N	U-E	U-N	N-E	N-U	U/(E+U)	E+U
Overall:	1.56	2.12	29.4	11.4	3.36	3.52	8.31	71.5
Quintile:								
Q1	1.67	0.89	29.0	7.37	4.01	5.30	8.11	87.2
Q2	1.60	2.02	29.3	11.6	3.55	3.98	8.40	73.8
Q3	1.53	2.56	29.5	12.8	3.32	3.41	8.41	67.5
Q4	1.49	2.83	29.6	13.5	3.22	3.13	8.35	64.4
Q5	1.45	3.15	29.7	14.1	3.10	2.86	8.32	60.9

NOTE: E: employment; U: unemployment; N: nonparticipation.
Means of levels ($\times 10^2$); Moments were computed from a simulation of 5,000 model periods.

Sources of fluctuations

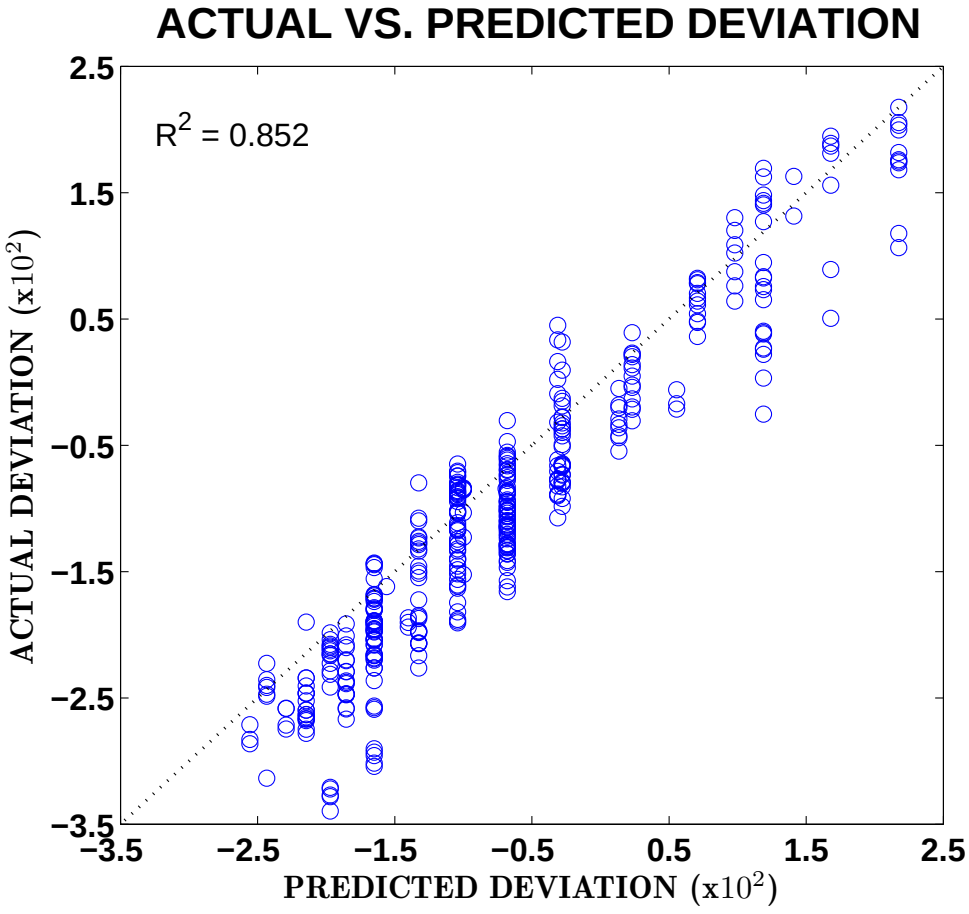

Figure 5: Business cycle implications: Actual vs. predicted deviation of unemployment from its mean

Sources of fluctuations

Table 4: Worker flows over the business cycle: data and model

	Flows						Stocks	
x	E-U	E-N	U-E	U-N	N-E	N-U	U/(E+U)	E+U
				(a) Data				
$\mathbb{C}\text{orr}(x, x_{-1})$	0.980	0.943	0.992	0.985	0.937	0.944	0.990	0.942
$\sigma(x)$	0.079	0.056	0.120	0.091	0.069	0.071	0.185	0.006
$\mathbb{C}\text{ov}(x,u)/\sigma(u)$	0.065	-0.016	-0.105	-0.073	-0.049	0.030	-	-0.003
				(b) Full experiment				
$\mathbb{C}\text{orr}(x, x_{-1})$	0.987	0.966	0.996	0.950	0.994	0.941	0.996	0.984
$\sigma(x)$	0.063	0.092	0.143	0.047	0.093	0.048	0.143	0.004
$\mathbb{C}\text{ov}(x,u)/\sigma(u)$	0.038	-0.080	-0.135	-0.022	-0.086	0.025	-	-0.003

Sources of fluctuations

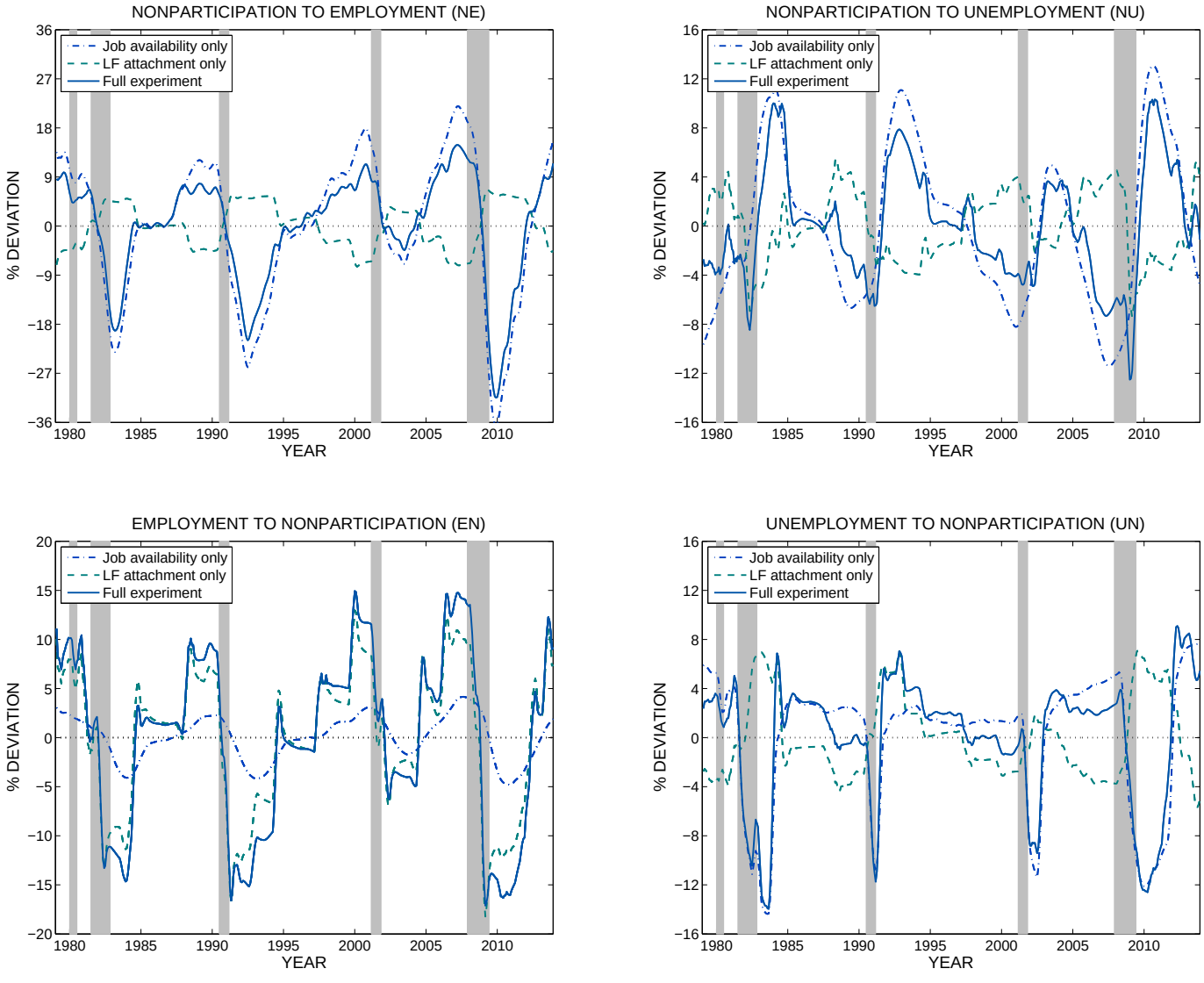

Figure 6: The ins and outs of the labor force: Numerical experiment

Sources of fluctuations

Table 5a: The ins of the labor force: The role of composition effects

	N-E			N-U		
	Actual	Predicted		Actual	Predicted	
		(a)	(b)		(a)	(b)
01/1980 to 07/1980	-5.00	-3.13	-3.32	11.49	0.80	1.93
07/1981 to 12/1982	-8.75	-13.11	-18.23	11.17	8.84	4.68
07/1990 to 03/1991	-9.78	-6.21	-9.25	1.77	1.58	1.15
03/2001 to 11/2001	-3.61	-4.45	-6.40	10.43	0.56	0.93
12/2007 to 06/2009	-11.75	-20.17	-27.65	16.90	8.58	7.58

NOTE: *E*: employment; *U*: unemployment; *N*: nonparticipation.
(a): Full experiment; (b): Changes in job availability only

Sources of fluctuations

Table 5b: The outs of the labor force: The role of composition effects

	E-N			U-N		
	Actual	Predicted		Actual	Predicted	
		(a)	(b)		(a)	(b)
01/1980 to 07/1980	-3.40	-0.89	-0.37	-5.48	-1.13	-1.36
07/1981 to 12/1982	-4.90	-11.54	-1.61	-10.26	-8.56	-12.30
07/1990 to 03/1991	-6.43	-7.63	-0.64	-4.00	-5.26	-6.95
03/2001 to 11/2001	-3.70	-4.04	-0.31	-10.99	-0.98	-1.87
12/2007 to 06/2009	-11.66	-17.79	-2.60	-21.24	-5.93	-10.98

NOTE: *E*: employment; *U*: unemployment; *N*: nonparticipation.
(a): Full experiment; (b): Changes in job availability only

Conclusion

- This paper is a structural attempt to study how fluctuations in the ins and outs of the labor force are shaped by:
  - Changes in job availability over the business cycle
  - Interaction with heterogenous degrees of labor force attachment
- Strong assumptions deliver strong results
  - A simple, intuitive job search model captures labor market flows well
  - Job creation and destruction rates drive the overall dynamics
- The model would also be relevant to study topics related to worker flows that do not pertain to the business cycle (e.g. life-cycle, gender differences)