LONG-TERM UNEMPLOYMENT AND THE GREAT RECESSION: EVIDENCE FROM UK STOCKS AND FLOWS

ONLINE APPENDIX

Appendix A. Composition of the unemployment pool - data and methodology

The UK's nationally representative Annual Population Survey (APS) combines responses from waves one and five of the LFS, for the whole year, as well as incorporating local and regional boosts to the sample to match its aim of providing representative data at the local authority level. To obtain more reliable estimates of working-age (male 16-64, female 16-59) unemployment levels across the duration distribution, I prefer this larger sample size dataset to the Quarterly Labour Force Survey. The increased sample size is also useful when specifying heterogeneous types of unemployed individuals over multiple levels (e.g. sex, age groups, duration of unemployment and industry of previous job). An indicative reference for the APS datasets is as follows: Office for National Statistics. Social and Vital Statistics Division. (2015). Annual Population Survey, January - December, 2004. [data collection]. 6th Edition. UK Data Service. SN: 5334. Table A1 contains notes on the variables used and how these have been transformed into the heterogeneous types used in the analysis. Table A2 gives the long-term shares of unemployment across the various sets of personal characteristics for some of the years used here.

The counterfactual levels of unemployment by duration $\{\tilde{S},\tilde{M},\tilde{L}\}_t$, that would have occurred had each type i's distribution over unemployment duration remained constant relative to three years previously, but allowing for the actual change over those years in the overall composition of types within the total unemployment pool, where $U = \sum_i U_i$, are similarly given by

$$\tilde{L}_t = \sum_i \left(\frac{L_i}{U_i}\right)_{t-3} \left(\frac{U_i}{U}\right)_t U_t. \tag{8}$$

By definition the counterfactual is consistent with the realised total level of unemployment, i.e. $\tilde{S}_t + \tilde{M}_t + \tilde{L}_t = U_t$. If there were no unemployed of type i at some duration three years previously, I simply retain their current distribution over duration in the counterfactual: this will make little quantitative difference since such types will have an insignificant weight.

Results for the counterfactual LTU share in 2007 relative to 2004, had each type's duration shares within unemployment remained constant, and likewise for 2010 and 2007, are given by Figures A1 & A2. Each panel accounts for both the age and sex composition of the unemployed, as well as one other level of heterogeneity. The small rise in the share of working-age unemployed who have been looking for work for over twelve months between 2004 and 2007, 21% to 24%, cannot be explained by these definitions of the composition. The change in composition with regards the occupation and industry of an individual's previous job marginally predicts a fall in the LTU share. The composition over when an individual left their last job has no effect.

TABLE A1

Notes on variables used from the Annual Population Survey, 2004-2013

	APS (2004) variable	*Notes*	*Transformations/categories*
Age groups	*age*		Groups as follows: 16-24, 25-34, 35-44, 45-54, 55-64/59.
Unemp. duration	*durun*	Minimum of the stated length of time looking for work and length of time since respondent's last job (*wnleft*). From the APS the small share of the weighted unemployed (less than 1%) who have no duration response is dropped from the sample.	Three categories used: 0-3 months, 3-12 months, 12 months +
Region	*govtof*	Thirteen UK Government office regions - all respondents.	Create ten categories by combining *North East* and *Yorkshire and Humberside*, *North West* and *Merseyside*, *East Midlands* and *West Midlands*.
Prev. job industry	*inds92l*	Standard Industrial Classification (SIC) 1992, industry divisions . From 2008 onwards, interviewers in the Labour Force Survey would classify occupations using the SIC2007. Details of how this differs from previous classifications can be found on the ONS website. To generate a consistent time series of employment by industry sector I make use of the conversion variable in the APS 2010, *in0792sl*. This was generated by the ONS by matching SIC2007 sub-class to a higher level of aggregation, i.e. division, in SIC1992, but is not available for 2013.	Create new categories from 19 divisions and missing values: (D) - Manufacturing, (F)- Construction, (G) - Wholesale/retail, (H-I) - Hotels, restaurants, transport, comms, (J-K) - Finance & real estate etc., (L-N) - Public sectors, (A-C, G, O-Q, outside UK) - Others, *Does not apply* (includes those with no previous job).
Prev. job occupation	*sc2klmj*	Standard Occupational Classification (SOC) 2000 - major occupation groups.	Retain nine occupation groups and include category for *Does not apply* (includes those with no previous job).
Reason left prev. job	*redylft*	Applies to all respondents who are not working and left job in 8 years before reference week.	Create five categories: (1-2) - Redundant/dismissed, (3) - Temporary job, (4-8) - Resigned/gave up work/early retirement, (9) - Other, (-9) - Does not apply (includes those with no previous job).
Type of employment sought	*tyemps*	Applies to all respondents looking for employment. Large majority responded (2-3). Other categories *No preference, Self-employment* etc.	Create three categories: (2) - Full time employee, (3) - Part-time employee, (1, 4-11) - Other.
When left last job (relative to unemp. spell starting)	*wnleft*	May differ from *durun* where there have been spells since last job where an individual has not looked for work, or where they have never had a job.	Three categories: Same time - *wnleft=durun*, Strictly longer - *wnleft>durun*, Never had paid employment.

Source: Author notes, but see also relevant dataset user guides held by the UK Data Service.

TABLE A2

Long-term shares of unemployment

		2004	*2007*	*2010*
Sex	Male	25.1	28.0	36.2
	Female	15.5	18.2	24.5
Age groups	16-24	12.5	16.0	23.5
	25-34	20.9	23.1	33.0
	35-44	27.4	31.0	36.0
	45-54	31.7	32.3	39.1
	55-64/59	37.6	37.7	43.0
Region	North East & Yorks.	41.9	37.9	42.8
	North West & Mersey.	20.9	26.4	34.4
	Midlands	22.6	24.4	30.2
	Eastern	20.6	25.2	34.2
	London	16.0	21.8	29.8
	South East	23.8	26.0	33.0
	South West	14.3	18.3	25.6
	Wales	16.8	17.7	30.2
	Scotland	20.1	22.3	30.4
	Northern Ireland	24.6	22.8	29.2
Industry of prev. job	Manufacturing	27.3	29.8	38.8
	Construction	23.6	22.3	36.3
	Wholesale, retail	15.6	17.4	29.8
	Finance, real estate	15.9	17.4	27.6
	Hotels, restaurants, transport, comms.	19.0	20.3	29.0
	Public sectors	13.3	18.4	25.1
	Other	18.4	21.6	28.1
	Does not apply	24.3	30.1	34.5
Occupation of prev. job	Managers and Senior Officials	19.9	19.0	28.1
	Professional occupations	17.3	16.1	22.3
	Associate Professional and Technical	15.6	18.2	24.4
	Administrative and Secretarial	12.8	15.3	28.1
	Skilled Trades Occupations	25.8	27.2	36.3
	Personal Service Occupations	11.8	18.9	26.1
	Sales and Customer Service Occupations	9.8	14.5	20.9
	Process, Plant and Machine Operatives	26.0	27.8	39.2
	Elementary Occupations	21.6	24.4	34.9
	Does not apply	24.4	30.1	34.8
All		21.2	23.8	31.6

Source: Author calculations using UK Annual Population Survey, ages 16-64/59, January-December 2004, 2007 & 2010.

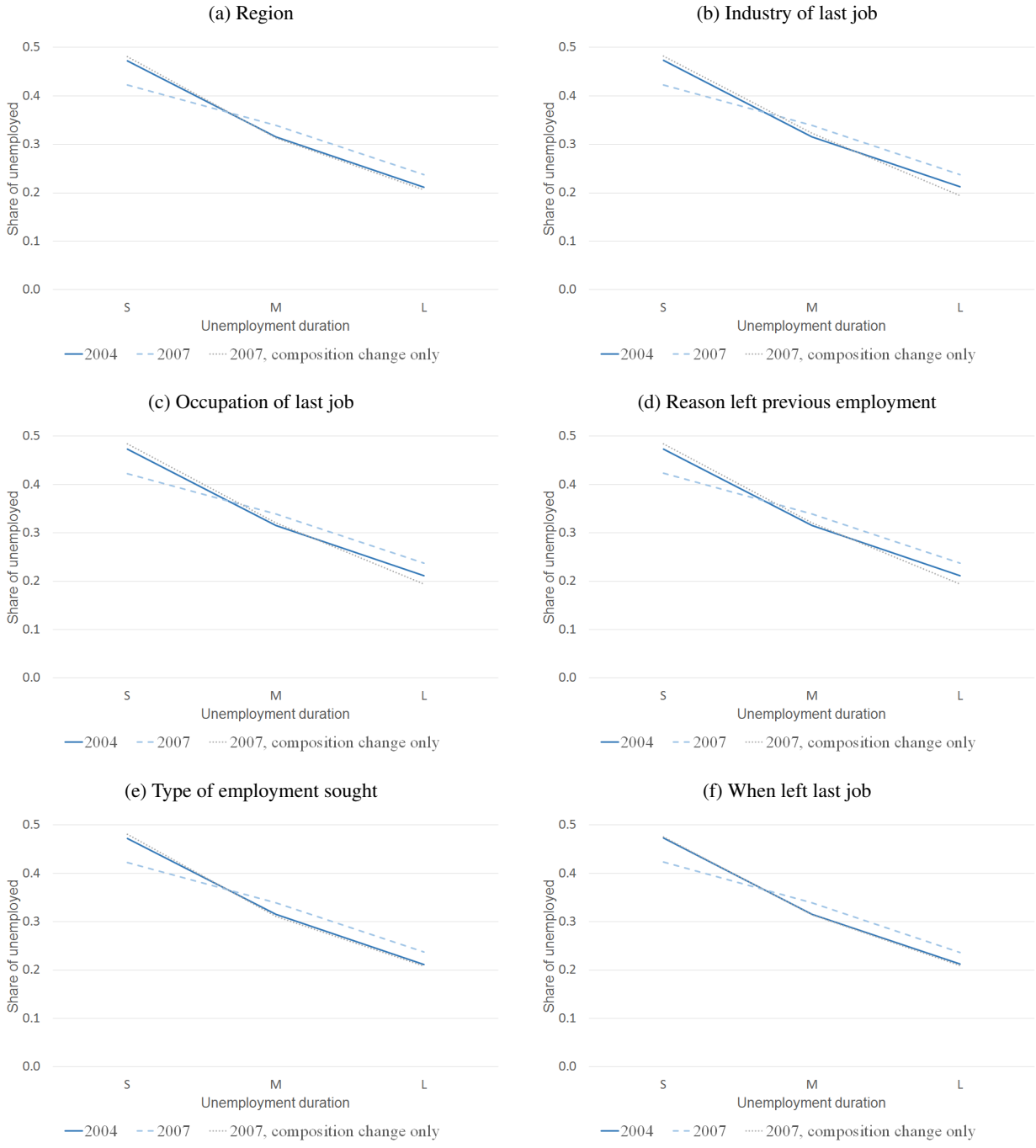
TABLE A2 (cont.)

Long-term shares of unemployment

		2004	*2007*	*2010*
Reason left prev. job	Redundant, dismissed	23.3	25.1	34.6
	Temporary job	16.3	19.6	24.4
	Resigned, gave up work, early retirement	15.2	18.4	29.1
	Other	21.4	20.2	29.3
	Does not apply	24.5	30.3	34.5
Type of employment sought	Full-time employee	23.2	24.9	33.9
	Part-time employee	13.0	15.9	21.8
	Other	23.1	29.8	35.2
When left last job (relative to unemployment spell starting)	Same time	26.1	27.8	38.9
	Strictly before	16.6	18.7	23.4
	Never had paid employment	20	24.4	28.4
All		21.2	23.8	31.6

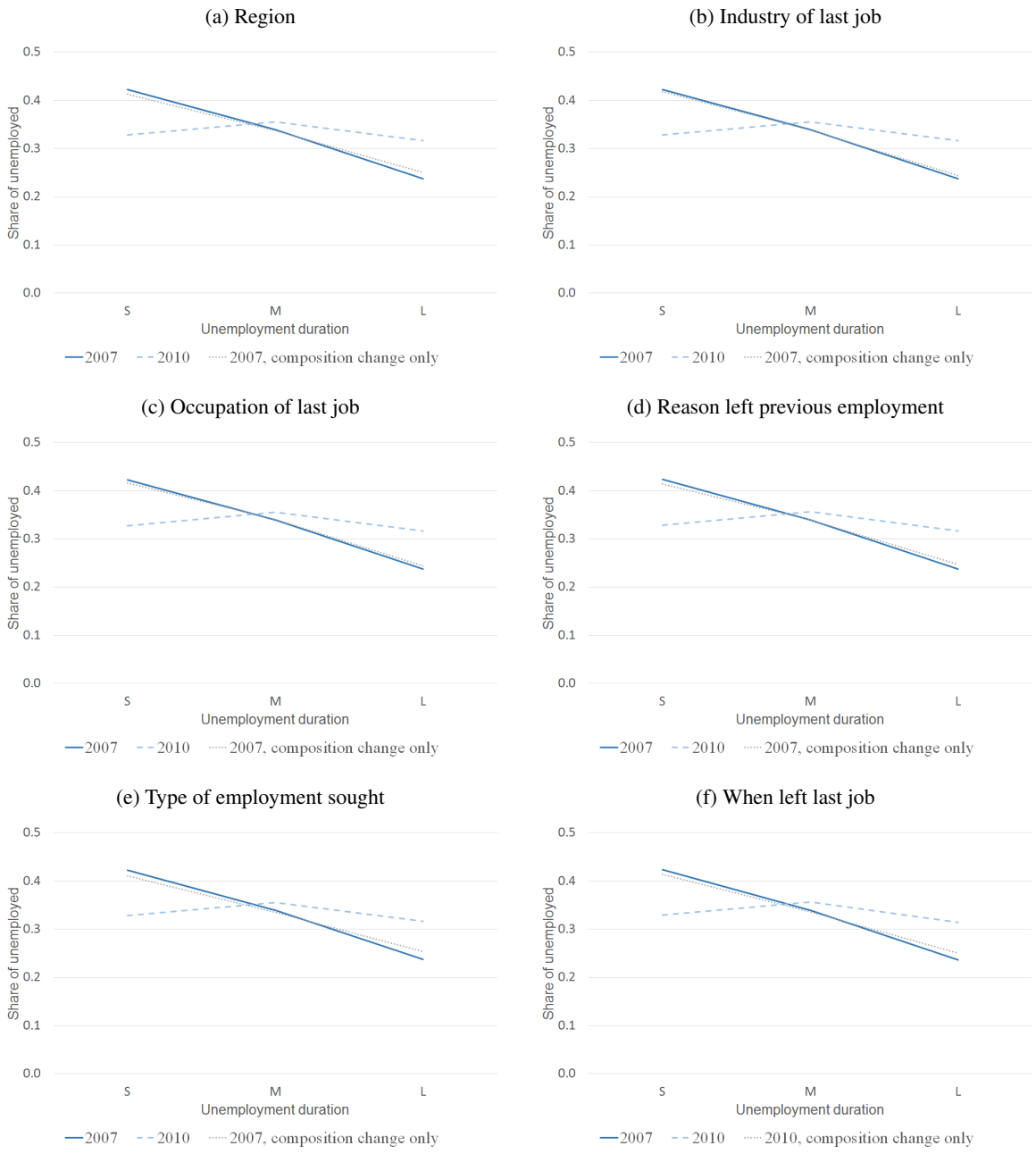
Source: Author calculations using UK Annual Population Survey, ages 16-64/59, January-December 2004, 2007 & 2010.

Figure A1. Distribution of unemployment over duration in 2004 and 2007, and the role of composition changes in between



Notes: Counterfactual gives unemployment shares for 2007 holding constant the distribution over $\{S,M,L\}$ for each stated type of heterogeneity, interacted with sex and age groups, from 2004, and applying the overall distribution of types in the unemployment pool from 2007.
Source: Author calculations using UK Annual Population Survey, ages 16-64/59, January-December 2004 & 2007.

Figure A2. Distribution of unemployment over duration in 2007 and 2010, and the role of composition changes in between



Notes: Counterfactual gives unemployment shares for 2010 holding constant the distribution over $\{S,M,L\}$ for each stated type of heterogeneity, interacted with sex and age groups, from 2007, and applying the overall distribution of types in the unemployment pool from 2010.
Source: Author calculations using UK Annual Population Survey, ages 16-64/59, January-December 2007 & 2010.

Appendix B. Labour market flows - data & adjustments

Seasonal adjustment

Given quarterly gross flows between states $\hat{XY}_t$ for $1997q2 \leq t \leq 2015q2$, measured from the longitudinal datasets, I first take the log difference from the series centred using a four quarter moving average, i.e. $\ln \bar{XY}_t = \ln \hat{XY}_t - \ln\left[(0.125\hat{XY}_{t-2} + 0.25\hat{XY}_{t-1} + 0.25\hat{XY}_t + 0.25\hat{XY}_{t+1} + 0.125\hat{XY}_{t+2})\right]$.
I the regress this on a set of quarterly dummies, as well as additional dummies for $t = 2000q4, 2001q1$, since there is a reduced sample of reported unemployment durations in the final quarter of 2000, which can be accounted for at this stage. Using the residuals/predicted values ε_t from these regressions, the seasonally adjusted gross flows series for $1997q4 \leq t \leq 2014q4$ are then given by $\tilde{XY}_t = \hat{XY}_t / \exp(\ln \bar{XY}_t - \varepsilon_t)$.

Stocks-flows consistent adjustment for measured transition rates

To adjust the measured transition rates to be consistent with national labour market statistics measures of the stocks I solve the following problem for each t:

$$\min_{\phi_t} (\phi_t - \tilde{\phi}_t)' \tilde{\mathbf{W}}_t^{-1} (\phi_t - \tilde{\phi}_t) \tag{9}$$

$$s.t. \quad \Delta \mathbf{z}_t = \mathbf{Z}_{t-1} \phi_t, \quad \{\mu_t\} \tag{10}$$

$$\mathbf{R}\phi_t = \mathbf{0} \qquad \{\nu_t\}; \tag{11}$$

i.e. I choose ϕ_t, a $(20x1)$ vector of transition rates between states, to minimise its distance from the equivalent $\tilde{\phi}_t$ estimated from the survey data, and where $\tilde{\mathbf{W}}_t^{-1}$ is proportional to the covariance matrix of $\tilde{\phi}_t$. This is subject to (10), which states that the change in population rates should be equal to the normalised gross flows, where $\mathbf{Z}_{t-1}$ is a $(4x20)$ matrix populated accordingly with population shares, and (11), where $\mathbf{R}$ contains the restrictions $p_{EM} = p_{EL} = p_{SL} = p_{LM} = p_{NM} = p_{NL} = 0$. The solution is given by

$$\begin{bmatrix} \phi \\ 1/2\mu \\ 1/2\nu \end{bmatrix}_t = \begin{bmatrix} \tilde{\mathbf{W}}_t^{-1} & \mathbf{Z}_{t-1}' & \mathbf{R}' \\ \mathbf{Z}_{t-1} & 0 & 0 \\ \mathbf{R} & 0 & 0 \end{bmatrix}^{-1} \begin{bmatrix} \tilde{\mathbf{W}}^{-1}\tilde{\phi} \\ \Delta \mathbf{z} \\ \mathbf{0} \end{bmatrix}_t . \tag{12}$$

'Cleaned' transition rates - specification (III)

As described in the main text, the primary assumption behind this robustness check is that an individual's employment status is most likely to have been recorded accurately. Starting from this strong assumption, all employment to unemployment flows are then recoded to *ES*. Then, where it is unambiguous, allowing for the possibility of unemployment restarts, if an individual is observed as unemployed up to three quarters consecutively subsequent durations are recoded accordingly. Further, observed transitions to a shorter duration between two quarters of LTU are reassigned to *LLL*, and the continuous observed unemployment spell *SMLL* is reassigned to *SMML*. Table B1 details the number of observed transitions reassigned as such.

Time aggregation bias correction - specification (V)

It is common in the literature to set out the stocks-flows decomposition in terms of continuous time equivalent hazard rates instead of transition probabilities. This is intended to have the advantage of accounting for time aggregation bias in measured transitions; i.e. movements between states, which could be important in explaining the cyclical behaviour of labour market rates, are ignored due to the frequency of data collection. Adjustments to account for this implicitly assume that hazard rates are constant and identical for all workers within a state and period. However, given the analysis of limited duration dependence of transition rates here, implicitly assuming that there is none within S, M, L is somewhat counter-intuitive. Nonetheless, since I isolate short-term unemployment as a separate state, where the majority of the time aggregation bias would be expected to occur, it would be remiss not to account for it in some way. As computed in EHS, the continuous time generator or hazard rate version of $\mathbf{P}_t$ is its principal logarithm, $\ln \mathbf{P}_t = \mathbf{F}_t$. However, this only exists and is unique under certain conditions on $\mathbf{P}_t$.[2] Fortunately, these conditions are always met for the series of naïve transition rates estimated here. The effect of the adjustment is substantial on the levels of transition rates to and from short-term unemployment. The implied hazard rates for the ES and SE flows are both approximately doubled. Given the much greater level of the latter transition rate, it follows mechanically that time aggregation would bias the β shares of the variance decomposition downwards for unemployment exits.

The computed hazard rates can then be used to replace the steady-state (2) with its continuous time equivalent,

$$\bar{\mathbf{z}}_t = -\Lambda_t^{-1} \lambda_t$$

where Λ_t and λ_t are equivalents of Π_t and π_t. The derivation of (4) and (6) is then identical besides the derivatives of the Taylor expansion taking a different analytical form.

[2] If $\mathbf{P}_t$ is 'embeddable' (non-singular) the only generator matrix is given by its principal logarithm when its eigenvalues are real, distinct and positive.

TABLE B1

'Clean' flows - unweighted number of quarter to quarter transition observations changed on account of reassignments, 1997q2-2015q2

	Freq.	*Percent*
Unchanged	3,093,122	99.69
EM, *EL*, *EU* to *ES*	7,769	0.25
ESL to *ESM*	673	0.02
ESML to *ESMM*	188	0.01
SMLL to *SMML*	324	0.02
LSL, *LML*, *LUL* to *LLL*	510	0.02

Notes: U here refers to the small number of observations where no duration data was recorded.
Source: Author calculations using Two Quarter Longitudinal Labour Force Survey, ages 16-64/59. Information on how these values vary over time is available on request.

TABLE B2

'De-NUN-ification' - unweighted number of quarter to quarter transition observations changed on account of reassignments, 1997q2-2015q2

	Freq.	*Percent*
Unchanged	3,097,667	99.84
NNLN or *NNMN* to *NNNN*	1,854	0.06
NLNN or *NMNN* to*NNNN*	1,536	0.04
LLNL to *LLLL*	420	0.02
LNLL to *LLLL*	288	0.00
MLNL MLLL	68	0.00
MMNL to *MMLL*	176	0.00
ENMN ENLN to *ENNN*	160	0.00
ESNM to *ESMM*	210	0.00
ESNL to *ESMM*	29	0.00
MNLL to *MMLL* (ambiguous)[†]	178	0.00

[†] Although this small number of observation remains ambiguous, it was decided on the balance of likelihood to reassign them.
Source: Author calculations using Two Quarter Longitudinal Labour Force Survey, ages 16-64/59. Information on how these values vary over time is available on request.

TABLE B3

Ratio of unweighted flows observations after adjustments to before, 1997q2-2015q2

	'Clean'	*'Clean' + 'deNUN'*
EE	1.00[†]	1.00
EL	0.00	0.00
EM	0.00	0.00
EN	1.00	1.00
ES	1.25	1.25
EU	0.00	0.00
LE	0.94	0.94
LL	0.99	1.02
LM	0.78	0.78
LN	0.98	0.78
LS	0.90	0.90
LU	0.57	0.57
ME	0.93	0.93
ML	0.95	0.99
MM	0.97	0.98
MN	0.97	0.80
MS	0.93	0.93
MU	0.91	0.91
NE	1.00	1.00
NL	1.00	0.75
NM	1.00	0.87
NN	1.00	1.01
NS	1.00	1.00
NU	1.00	1.00
SE	1.06	1.06
SL	0.90	0.90
SM	1.11	1.12
SN	1.03	1.02
SS	1.02	1.02
SU	1.19	1.19
UE	0.72	0.72
UL	0.64	0.64
UM	0.83	0.83
UN	0.94	0.94
US	0.80	0.80
UU	0.94	0.94

[†] # of observations after / # of observations before.

Notes: U here refers to the small number of observations where no duration data was recorded.

Source: Author calculations using Two Quarter Longitudinal Labour Force Survey, ages 16-64/59. Information on how these values vary over time is available on request.

TABLE B4

Stocks-flows decomposition: including adjustments for classification errors, 1998q2-2014q4

	*(III)**				*(IV)***			
	Δe	Δu	Δu_{rate} †	Δl	Δe	Δu	Δu_{rate} †	Δl
Δp_{EU}	0.25§	0.35	0.35	0.06	0.25	0.35	0.35	0.07
Δp_{EN}	0.14	0.00	0.00	0.01	0.14	0.00	0.00	0.01
Δp_{UE}	0.32	0.41	0.41	0.39	0.31	0.42	0.43	0.40
Δp_{UN}	0.01	0.21	0.19	0.32	0.01	0.19	0.17	0.29
Δp_{NE}	0.32	0.00	0.03	0.00	0.31	0.00	0.03	0.00
Δp_{NU}	0.00	0.05	0.04	0.01	-0.01	0.05	0.04	0.01
Δp_{UU}	0.01	0.02	0.02	0.10	0.01	0.02	0.02	0.10
Initial val.	0.01	0.02	0.02	0.05	0.01	0.02	0.02	0.05
Approx. err.	-0.05	-0.06	-0.06	0.04	-0.04	-0.05	-0.05	0.07

* (II) and using classification error adjusted transition probabilities as $\tilde{\phi}_t$.
** (III) and using 'de-*NUN*-ified' transition probabilities as $\tilde{\phi}_t$.
† $u_{rate} = u/(u+e)$
§ Interpretation: Share of variance in the quarterly change in the employment rate accounted for by past and present quarterly changes in p_{ES} (or hazard rate equivalent), i.e. $\beta^e_{EU} = \frac{cov(\Delta e_t, \{c_{EU,t}\}_1)}{var(\Delta e_t)}$.
Source: Author calculations using Two Quarter Longitudinal Labour Force Survey & Labour Market Statistics, ages 16-64/59.

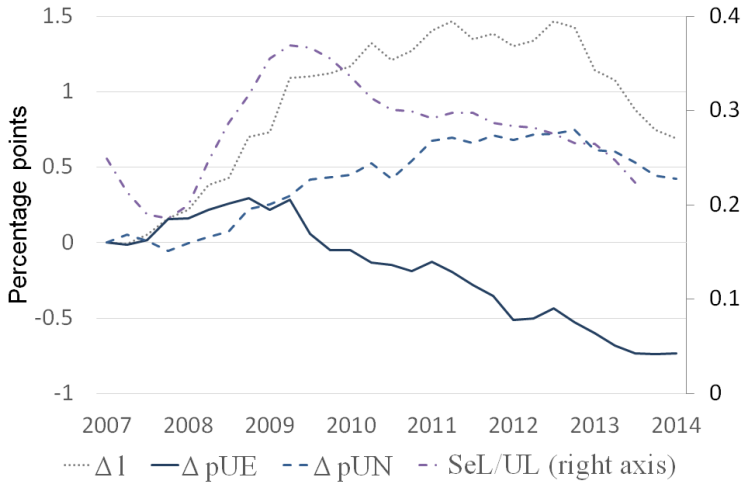
TABLE B5

Stocks-flows decomposition: including time aggregation bias adjustment, 1998q2-2014q4

	*(I)**				*(VI)***			
	Δe	Δu	Δu_{rate} †	Δl	Δe	Δu	Δu_{rate} †	Δl
Δp_{EU}	0.27§	0.36	0.36	0.10	0.28	0.26	0.27	0.10
Δp_{EN}	0.16	0.00	0.00	0.00	0.12	-0.01	0.00	0.00
Δp_{UE}	0.26	0.32	0.32	0.26	0.32	0.39	0.39	0.29
Δp_{UN}	0.00	0.17	0.15	0.33	-0.01	0.29	0.26	0.41
Δp_{NE}	0.30	0.01	0.03	0.00	0.28	0.01	0.03	0.00
Δp_{NU}	-0.03	0.14	0.12	0.16	-0.05	0.05	0.04	0.12
Δp_{UU}	0.00	0.01	0.01	0.10	0.02	0.03	0.03	0.05
Initial val.	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.03
Approx. err.	0.02	0.01	0.01	0.01	0.02	-0.03	-0.02	0.00

* 'Naïve' transition probabilities, i.e. with no zero value restrictions when adjusting $\tilde{\phi}_t$.
** 'Naïve' hazard rates, i.e. with time aggregation bias adjustment.
† $u_{rate} = u/(u+e)$
§ Interpretation: Share of variance in the quarterly change in the employment rate accounted for by past and present quarterly changes in p_{ES} (or hazard rate equivalent), i.e. $\beta^e_{EU} = \frac{cov(\Delta e_t, \{c_{EU,t}\}_1)}{var(\Delta e_t)}$.
Source: Author calculations using Two Quarter Longitudinal Labour Force Survey & Labour Market Statistics, ages 16-64/59.

Figure B1. Cumulative long-term unemployment contributions from exit rates and the share of gross in-flows previously employed, 2008-2014



Notes: Series indexed to zero in 2007q4. Interpretation of series on left axis is the cumulative increase in long-term unemployment's population share since 2007 accounted for by past and present changes in transition rates.
Source: Author calculations using Two Quarter Labour Force Survey & Labour Market Statistics, ages 16-64/59. Transition rates calculated using specification (I).

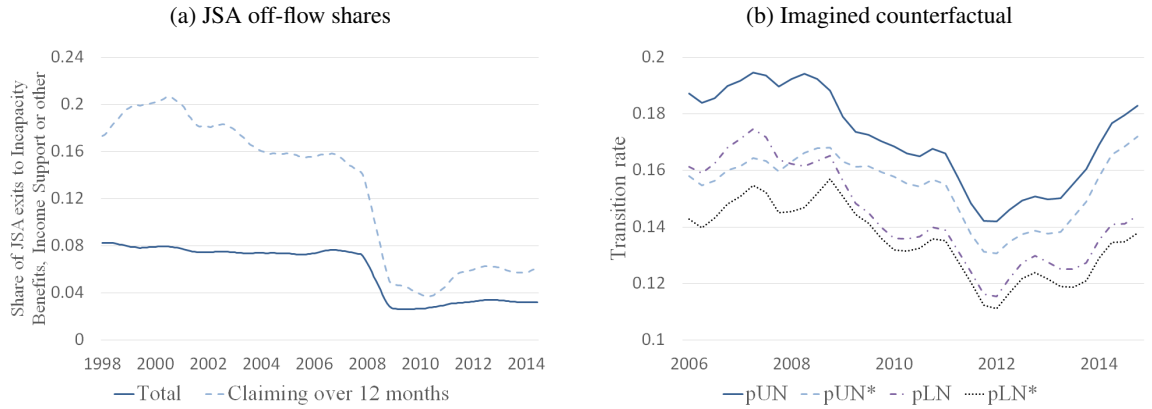
Appendix C. The potential role of labour market policy changes

It is possible that changes in UK Government labour market policy are responsible for some of the results. Upon becoming unemployed in the UK, the typical process for many individuals is to first 'sign on' to Jobseeker's Allowance (JSA). This is an active benefit in so far as claimants must look for work and be available to start at short notice, meaning that a LFS respondent receiving such payments would in most cases be classified as ILO unemployed.[3] After signing on, eligibility for other alternative benefits is considered, such as Income Support (primarily for lone parents) and allowances related to disability or care. If eligibility is confirmed there is no monitored requirement to look for work. Although individuals in receipt of such payments could be classified as ILO unemployed instead of inactive, this is less likely.[4] If there was a tightening of eligibility criteria for inactive benefit payments since the Great Recession, this could manifest itself in the aggregate flow rates as observed. Tightening criteria could immediately lead to a reduction in *UN* flows, but the effect on the reverse flow would be drawn out as reviewing eligibility and the fitness to work of those receiving disability or carer benefits is a slow process. There was such a tightening in the UK, with the stricter Employment Support Allowance (ESA) gradually replacing Incapacity Benefit towards the end of 2008. Furthermore, in November 2008, the age limit of the youngest child for lone parents to be eligible for Income Support was lowered to twelve for all new claimants. Out-of work parents would have had to claim JSA instead and actively look for work.[5] Panel (a) of Figure C1 demonstrates the effect of these policy changes, using administrative data, through the immediate downward shift concurrently in the share of all off-flows from JSA to either Income Support, incapacity benefits or some other benefit, for both all claimants and those claiming for over twelve months.[6] The majority of the fall is in off-flows to Incapacity Benefit. Although many of these

[3]Using the January-December 2007 Annual Population Survey, 21% of JSA recipients were classified as ILO inactive.
[4]Using the January-December 2007 Annual Population Survey, 13% of Income Support recipients were classified as active.
[5]The age limit was gradually lowered for existing claimants, starting the following year, to five by October 2011.
[6]Off-flows series accessed from NOMIS, ONS, 10/02/2016. Although these administrative flows data are detailed in terms of the destinations following and reasons for a claim ending, they are incomplete in so far as the destination of some claimants is unknown, and the rate at which claimants complete exit questionnaires is not constant over time, having reduced in recent years.

claimants may have eventually moved to ESA, this is not recorded. To assess whether this could have affected the estimated cyclical behaviour of transition rates, I imagine a counterfactual whereby all JSA off-flows to other benefits are simply subtracted from the actual number of observed *UN* and *LN* gross flows, not accounting for the introduction of the replacement ESA. Panel (b) of Figure C1 compares actual transition rates with imagined ones which negate these JSA off-flows, p_{UN^*} and p_{LN^*}. The policy changes could account for a not insignificant amount of the cumulative decline in exit rates from 2008, but the cyclical pattern remains. Given that this represents the absolute upper limit of any potential policy effects occurring concurrently, the actual effect is likely to have been much smaller.

Figure C1. Share of JSA off-flows to inactive benefits and an estimate of the maximum potential policy impacts on estimated flows series p_{UN} and p_{LN}



Source: Author calculations using Two Quarter Labour Force Survey, ages 16-64/59, 1997q2 - 2015q2, and NOMIS, ONS off-flows series from Jobseeker's Allowance - using raw transition rates.