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Labour Mobility and Earnings in the UK, 1992-2016

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Nontechnical Summary

We document aggregate changes in the UK labour market over the period 1992–2016. We examine the stock (or total number) of workers in different labour market states such as employment and unemployment; the number of workers flowing between these states; and earnings.

We draw information from a combination of the British Household Panel Survey (BHPS) and the UK Household Longitudinal Study (UKHLS, also known as Understanding Society). The BHPS was discontinued in 2008 and replaced by the UKHLS, a larger survey with a slightly different design. We offer a new way of cleaning, imputing and harmonising labour market history data between BHPS and UKHLS, which we validate by benchmarking some of our time series against those produced by the Office for National Statistics (ONS). We thus offer the first (to our knowledge) aggregate picture of UK labour market stocks, flows, and earnings based on a “spliced” BHPS-UKHLS data set.

We extend previous aggregate analyses of the UK labour market in two ways. First, we pay special attention to the distinction between paid employment and self-employment. We think it important to single out self-employment, particularly in the light of recent debates on the role played by new forms of self-employed jobs and the “gig economy” during the post-Great Recession period. Second, we go beyond a purely aggregate picture by dividing our sample into low and high education groups. We find that many of the key labour market variables we track behave quantitatively and sometimes qualitatively quite differently between these two education groups over our sample period.

The standard approach to studying unemployment dynamics is to decomposes changes in the stock of unemployment into those caused by changes of in the flows of workers into unemployment (from employment or inactivity) and changes in the flow of workers out of unemployment (to employment and activity). We extend this standard approach by explicitly accounting for all flows between unemployment, inactivity, paid employment, and self-employment. This “four state” approach allows us to document the share of unemployment changes explained by flows between unemployment and self-employment.

LABOUR MOBILITY AND EARNINGS IN THE UK, 1992-2016*

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Abstract

We combine information from the British Household Panel Study (BHPS) and the UK Longitudinal Household Study (UKHLS, a.k.a. *Understanding Society*) to construct consistent time series of aggregate worker stocks, worker flows and earnings in the UK over the 1992-2016 period for all workers as well as for two separate education groups. We propose a method to harmonise data between the BHPS and UKHLS, which we validate by checking the consistency of some of our headline time series with equivalent series produced from other sources, notably by the ONS. In addition to drawing a detailed aggregate picture of the UK labour market over the past two and a half decades, we hope that our analysis will help demonstrate the usefulness of a combined BHPS/UKHLS data set for the analysis of UK labour markets.

Keywords: Unemployment Rate. Labour Market Flows. Self-Employment.

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1 Introduction

We document aggregate changes in worker stocks, worker flows, and earnings in the UK labour market over the period 1992-2016.

We draw information from a combination of the British Household Panel Survey (BHPS) and the UK Household Longitudinal Study (UKHLS, also known as *Understanding Society*). The BHPS was discontinued in 2008 and replaced by the UKHLS, a larger survey with a slightly different design. We offer a new way of harmonising labor market history data between BHPS and UKHLS, which we validate by benchmarking some of our time series against those produced by the Office for National Statistics (ONS). We thus offer the first (to our knowledge) aggregate picture of UK labour market stocks, flows, and earnings based on a “spliced” BHPS-UKHLS data set.

We extend conventional aggregate analyses in two ways. First, we pay special attention to the distinction between paid employment and self-employment. We think it important to single out self-employment, particularly in the light of recent debates on the role played by new forms of self-employed jobs and the “gig economy” during the post-Great Recession period. Second, we go beyond a purely aggregate picture by dividing our sample into a low and a high education group. We find that many of the key labour market variables we focus on (transition rates, earnings, etc.) behave quantitatively and sometimes qualitatively quite differently between these two education groups over our sample period.

We first establish — or corroborate — the following set of facts:

1. The transition rates in and out of work, as well as the job-to-job transition rate have been on a downward trend since around 2000, although that decline has been showing signs of slowing down since the Great Recession. This partly echoes similar findings for the US economy. Moreover, the decline in transition rates affected both education groups to roughly similar extents.
2. Our series confirms that, after over 15 years of steady growth, real labour earnings started falling in 2008 and have been very subdued ever since. The education premium, however, has remained roughly stable, apart from a noticeable spike around the Great Recession.¹
3. At the aggregate level, real pay growth is more strongly associated with the job-to-job transition rate than with other measures of labour market slack — notably the unemployment rate or the unemployed’s job finding rate — again echoing similar to evidence on the US economy (Moscarini and Postel-Vinay, 2017).

We then focus on self-employment. In the nearly two decades leading up to the Great Recession, self-employment in the UK appeared countercyclical and negatively correlated with paid employment. Then it started rising sharply during the Great Recession and has continued rising alongside paid

¹The size and importance of that spike depend a bit on the particular measure of income used to construct the education premium. See Section 5.3 for details.

employment ever since the end of the recession. That is, the post-recession recovery of the overall employment rate in the UK was due, in significant part, to an increase in the self-employment rate. Beyond that, we also establish the following:

4. Self-employment rates have been on the rise since the mid 2000s, for both education groups. That trend resulted from a decline in self-employment outflow rates (towards unemployment, inactivity or paid employment) that dominated the simultaneous decline in self-employment inflow rates.
5. While the incidence of self-employment increased in parallel for both education groups since the mid 2000s, the counterpart to that increase was a decline in inactivity rates for the high-educated, and a (relative) decline in paid employment for the low-educated workers. Relatedly, the high-education group experienced higher turnover in and out of self-employment than the low-education group, albeit with a more favourable inflow/outflow balance.
6. The education premium has been consistently higher amongst employed than amongst self-employed workers and has not shown any clear trend for either category.
7. The self-employment premium has stayed consistently higher for the low-education than for the high-education group. This education gap, however, has narrowed since the early 2000s: the self-employment premium of high-educated workers has remained roughly stable, whereas that of low-educated workers has dropped sharply over a few years around the mid-2000s.

Finally, we extend the popular “ins-and-outs” approach to decomposing unemployment dynamics by explicitly accounting for all flows between unemployment, inactivity, paid employment, and self-employment. The “ins-and-outs” approach typically decomposes the variance of changes in predicted steady-state unemployment into an inflow share and an outflow share (e.g. Petrongolo and Pissarides, 2008; Shimer, 2012). This decomposition has been extended by various authors (Fujita and Ramey, 2009; Elsby, Michaels, and Solon, 2009; Smith, 2011 for the UK) to separately account for flows between unemployment and employment and flows between unemployment and inactivity (a three-state world). As previously stated, we further extend the method to a four-state world and account for the share of unemployment dynamics explained by flows between unemployment and self-employment.

Our “aggregate” results are very close to those of Smith (2011): in particular, we find that, in total, unemployment inflows account for a little under 60% of the variance in unemployment changes. Focusing on self-employment, we find that flows between unemployment and self-employment explain an arguably modest share of the variance of unemployment changes (about 5.3% in total, mostly because of separations from self-employment into unemployment). However that share differs between education groups, and is much more important (almost 6%) for the high-educated than for the low-educated (2%).

The rest of this paper is organised as follows. In Section 2 we explain our dataset, the definition of variables, the difficulties we faced to construct our series and our suggested solutions to overcome those. In Section 3, we document stock rates. We document transition rates in Section 4. In the Section 5, we

establish stylised facts on earnings. In Section 6 we go through the relationship between job mobility and pay growth. Section 7 concludes.

2 Data

2.1 Generalities

The British Household Panel Survey (BHPS) is an annual longitudinal study which follows all adult members of around 10,000 households in the UK from 1991 until the end of 2008.² Following the final BHPS interviews at the end of 2008, all remaining respondents were invited to participate in the UK Household Longitudinal Study (UKHLS, a.k.a. *Understanding Society*), a successor to BHPS which follows a larger sample of around 40,000 households and collects data on a broader range of topics.

Interviews for wave 1 of UKHLS began in 2009, with BHPS sample members joining in wave 2. Interviews for each BHPS wave were completed within one calendar year. By contrast, interviews for each wave of UKHLS take place over a period of 24 months, but these 24 month periods overlap to ensure that each individual is interviewed once a year. So, for example, wave 1 interviews took place in 2009 and 2010, wave 2 interviews took place in 2010 and 2011, wave 3 in 2011 and 2012, and so on. Wave 8, which is the most recent release, contains information from interviews conducted in 2016 and 2017. A consequence of the overlapping waves in UKHLS is that data for 2009 and 2017, the first and last years currently covered by the data, relate to only half of the UKHLS sample (as half of the sample did not have their wave 1 interview until 2010, and half of the responses to interviews conducted in 2017 will not be released until wave 9). Data in these years are therefore less reliable than other years of UKHLS.

Cross-sectional weights are supplied by BHPS and UKHLS to ensure that each cross-section of both panels is representative of the UK population at the time. Those weights are designed to adjust for different probabilities that each individual is selected into the sample and different probabilities of sample attrition, including selective attrition of BHPS sample members between BHPS and UKHLS. We consistently use those weights in this paper.

2.2 Individual employment histories

While each sample member is interviewed at annual intervals, respondents are asked to report job histories since the time of their previous interview in each wave. We use these recalled job histories to construct a dataset containing each individuals' employment status and any transitions between states

²The original BHPS panel consisted of 10,300 individuals from around 5,500 households in Great Britain. The survey was expanded in 1999 to include an extra 1,500 households from each of Scotland and Wales, and again in 2001 to include an extra 2,000 households from Northern Ireland. These additional samples included 3,659 individuals from Scotland, 3,852 individuals from Wales and 4,335 individuals from Northern Ireland.

(or from one job to another) in each month of the period since their previous interview.³

In addition to this, individuals are asked to recall their complete employment history when they are interviewed for the first time. In principle, this feature of the survey would allow us to estimate employment rates and transitions in the period before BHPS started in 1991, and also for new UKHLS members in the period before 2009. However, this retrospective data suffers from two main problems: recall bias and the lack of pre-panel weights (we explain those issues in greater detail in the appendix). For these reasons, we have not included pre-survey employment histories in any of our analysis: individuals enter our data on the date of their first interview.

We face two additional difficulties in our construction of monthly employment histories: inconsistencies between the reported end date of one employment spell and the start date of the next, and inconsistencies between information reported in different waves. First, in some cases, the date an individual recalls ending one spell of employment, unemployment or inactivity does not match the date at which they report having started their next spell. This results in either a gap in the individual's employment history or a period where labour market spells overlap. In such cases, we systematically set the start date for all non-left censored spells equal to the end date of the previous spell.

Second, the job histories reported by individuals sometimes contradicts information provided in previous waves. For example, an individual may have reported being employed at the time of their wave-1 interview, but reports a retrospective calendar of activities in wave 2 that implies that they were non-employed at the date of their wave-1 interview. In such cases, we give precedence to information provided in older interviews over information provided subsequently, i.e. we give precedence to information provided about labour market spells provided at interviews closest to those spells.

The rules that we apply to rectify inconsistencies in individual responses are thus in the spirit of the "Closest Interview Method" discussed by Smith (2011).

2.3 Sample selection

We construct monthly employment histories for all respondents in BHPS and UKHLS aged between 16 and 64 at the time of their interview. (Sample members therefore leave our sample on their 65th birthday and join our sample on their 16th birthday.) This selection is intended to make our analysis comparable with employment aggregates produced constructed by the Office for National Statistics (ONS) based on the UK Labour Force Survey (UKLFS).

As explained above, we drop all employment histories that pre-date a respondent's initial interview. This results in smaller cross-section sample sizes at the start of BHPS in 1991 (for dates when wave

³Our adoption of a monthly frequency can potentially result in aggregation error. This is because an individual may have more than one transition within a month (for example finding and then losing a job). Shimer (2012), Elsby, Michaels, and Solon (2009) and Fujita and Ramey (2009) show that the level of turnover is affected by time aggregation bias. However, Fujita and Ramey (2009) indicates that this hardly affects the cyclical of turnovers. Nekarda (2009) argues that this is because both inflows to and outflows from unemployment co-vary positively with the business cycle and these two effects roughly offset each other. Moreover, Petrongolo and Pissarides (2008) also confirm the absence of cyclical bias from time aggregation using UK LFS quarterly data.

1 interviews were not yet complete). Likewise, cross-section sample sizes become smaller again in the most recent wave of UKHLS in 2016 (for dates in which some respondents had already completed their final interview and so had left our sample). We cut those small-sample dates and restrict our time window to the period January 1992 to December 2016.

Final BHPS interviews were conducted in the third quarter of 2008, and the first UKHLS interviews were not conducted until January 2009. In constructing our monthly series, we switch from using BHPS data to UKHLS data in October 2008. During this “changeover” period between the two surveys, the only information we have is from the 9,230 BHPS sample members who agreed to participate in UKHLS (and were aged between 16 and 64).

Our final sample contains 89,060 individuals (a total of 4.9 million person-months) and 126,276 transitions between employment states. This total is made up of 27,093 individuals (2.02 million person-months) with 61,735 transitions for the period covered by BHPS from January 1992 until October 2008 and 71,176 individuals (2.89 million person months) with 64,478 transitions for the period from October 2008 until January 2016 covered by UKHLS. 9,288 individuals from the BHPS sample continued into the UKHLS sample.

2.4 Definition of labour market states

We consider four possible employment states, which we label as follows: employed (E), self-employed (S), unemployed (U), and inactive (I). In some of our analysis, we combine employment and self-employment into a single “in work” state $W = E \vee S$. We assign individuals to states in each month based on their self-reported status at the end of the month. The four states are defined as follows.

- *Employment* (E) includes all individuals who report being employed (part-time or full-time), in an apprenticeship, on maternity leave, working as unpaid family workers or participating in a government training scheme. This corresponds with the ONS definition of employment.⁴ Including women on maternity leave in the definition of employment is consistent with Smith (2011).
- *Self-employment* (S) includes all individuals who report being self-employed.
- *Unemployment* (U) includes individuals who satisfy any of the following criteria: (1) report being unemployed, (2) report having searched for work in the four weeks prior to their interview while not being employed, or (3) report having claimed unemployment benefits while not reporting being employed.⁵

⁴See, for example, www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/may2017.

⁵For example, we classify an individual as being unemployed if they report being out of work due to long-term sickness but have either searched for work or claimed unemployment benefit in the four weeks prior to their interview. If an individual is out of work due to long-term sickness and has not searched for work or claimed unemployment benefit, we classify them as inactive. The UKLFS defines an individual as being unemployed if they are out of work, have searched for work in the last four weeks, and are available to start work in the next two weeks. We have also used self-reported

- *Inactivity (I)* includes all individuals who are not employed, self-employed or unemployed. This includes people who (1) report being out of work due to long-term sickness, in full-time education, caring for family members, in retirement, or for “other reasons”, (2) have not searched for work in the four weeks prior to their interview, and (3) have not claimed unemployment benefits.

For later use, we also define two education levels and assign respondents to either based on their self-reported highest qualification:

- the *low-education group* is defined as those with strictly less than A-levels education (end of secondary education);
- the *high-education group* is defined as those with A-levels education or above.⁶

2.5 Why BHPS and UKHLS?

We use a combination of BHPS and UKHLS to document UK labour market indicators. An alternative would have been to use the UKLFS. What are the pros and cons of each dataset? The UKLFS has a larger cross-sectional sample size (nearly three times as large as the UKHLS). It was not interrupted at such an unfortunate time as the end of 2008, and so does not require the “splicing” that BHPS and UKHLS do. While those indisputably argue in favour of the UKLFS, we believe that the BHPS-UKHLS combination has five key advantages (which are also emphasised by Smith, 2011). Those are (1) a higher frequency of observations: calendars of activities in BHPS and UKHLS allow the construction of monthly series, whereas it is only possible to construct series at quarterly frequency from the UKLFS; (2) a better tracking of respondents: BHPS and UKHLS sample designs are such that if individuals move their address or households, they will be tracked, whereas the UKLFS is an address-based sample and so does not track respondents if they move; (3) a longer time span: BHPS and UKHLS follow individuals for a much longer period than the UKLFS, with some respondents being present throughout the entire 1992-2016 sample period and are thus observed through most of their working life, while the UKLFS only follows each respondent for five quarters, which allows for a maximum of four labour market transitions; (4) fewer proxy responses: the frequency of proxy responses is around 1 percent in BHPS and 8 percent in UKHLS, compared to almost 30 percent in the UKLFS; (5) face-to-face interviews: in BHPS and UKHLS, all individuals are interviewed face-to-face and separately (when possible), whereas in the UKLFS only the first interview is face-to-face and the other four interviews are carried out by telephone.

Finally, one contribution of this paper is to provide an algorithm for data imputation and cleaning to produce reliable aggregate series based on the combination of BHPS and UKHLS. As explained

unemployment status and receipt of unemployment benefit in our definition of unemployment to make efficient use of the survey data, which we expect is subject to measurement error.

⁶Both BHPS and UKHLS have an “other qualifications” category, which is included in the low-education group for this study.

below, one of our measures of reliability is closeness to the corresponding series published by the ONS based on UKLFS data. Given that BHPS and UKHLS cover a much wider range of variables than the UKLFS, we think it is useful to produce reliable aggregate time series based on those two data sets, which can be used in conjunction with other variables in any economic analysis based on those same data sets.

3 Stocks

3.1 Preliminary remarks

We denote labour market stocks consistently with the way we label labour market states. For example, we denote the total number of employed workers in a given month t by E_t , the total number of self-employed by S_t , etc. Following this notation, the total number of people who are in work in month t is $W_t = E_t + S_t$. From those aggregate stocks, we derive the corresponding rates. The employment rate is defined as $\frac{E_t}{W_t + U_t + I_t}$. The rates of self-employment, and inactivity are defined analogously. So is the total employment rate (including the self employed), $\frac{W_t}{W_t + U_t + I_t}$. The unemployment rate equals $\frac{U_t}{W_t + U_t + I_t}$.

All of the series plotted in this paper are smoothed using a 24-month moving average filter centred in the current month. Moreover, as discussed above the data are particularly noisy at the end of 2008 and through 2009, the period covered by the first wave of UKHLS. In all of the charts below, we highlight this period using two vertical lines. We also exclude it from the regression analyses carried out in Section 6.

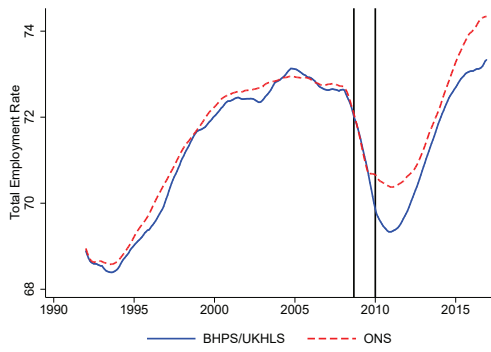
3.2 Aggregate rates

Figure 1 shows our estimates of the monthly rates of total employment, unemployment, self-employment, and inactivity. The ONS publishes series of those four rates, based on the UKLFS. Figure 1 also shows those ONS series, for comparison.⁷

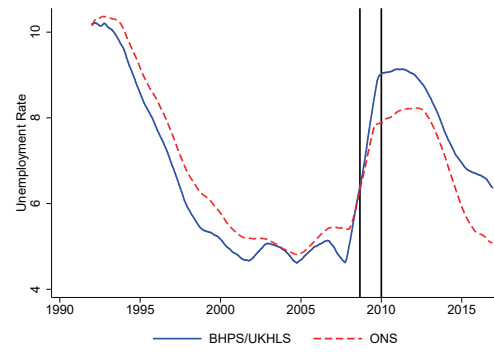
Our estimates of the rates of total employment and unemployment are, reassuringly, very close to the ONS series, even during the changeover period 2008 to 2010. The only noticeable discrepancy is that the BHPS/UKHLS-based employment rate dips a little lower than the ONS one in the immediate aftermath of the Great Recession. Our unemployment rate series mirrors that and peaks a little higher than the ONS series. There are small discrepancies between the two inactivity rate series, with the BHPS/UKLHS-based series being more volatile than the ONS one in the period where the quality of our data is low. Yet the two series of inactivity rates follow the same downward trend.

The self-employment rate series constructed using BHPS/UKHLS follows a similar trend to its ONS counterpart, however the latter is around half a percentage point higher between 1995 and 2003, and

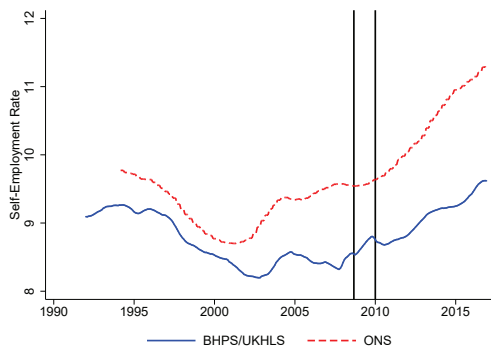
⁷The ONS series we have used are the aggregate employment, unemployment and inactivity rates among people aged 16-64 from ONS Labour Force Survey Table A02: Labour Force Survey Summary.



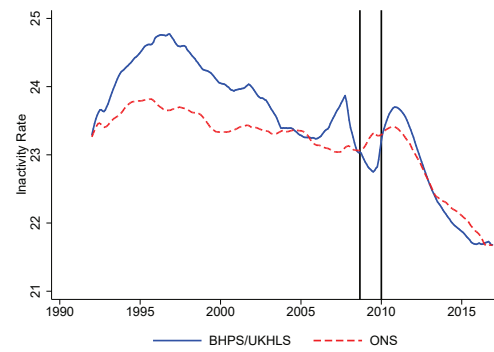
(a) Total employment (in-work) rate



(b) Unemployment rate



(c) Self-employment rate



(d) Inactivity rate

Figure 1: Aggregate monthly rates: BHPS/UKHLS *vs.* ONS

almost two percentage points higher in the rest of sample period (Figure 1c). Contrary to the ONS total employment, unemployment, and inactivity rate series, which represent individuals aged 16-64, the ONS uses all individuals aged 16 and above to construct the self-employment rate. By contrast, all of our BHPS/UKHLS series, including the self-employment rate, are consistently based on individuals aged 16-64. This may explain some of the discrepancy between our self-employment series and the ONS one.



Figure 2: Monthly self-employment rate

Figure 2a shows the two components of the total employment (or “in-work”) series, namely employment and self-employment, as constructed using BHPS and UKHLS (note the different scales of the two series). It shows that the 5 percentage point fall in the total employment rate during the Great Recession (Figure 1a) resulted from the combination of an even larger fall in the employment rate of around 6.5 percentage points and an *increase* in the self-employment rate. The rates of self-employment and employment appear to be negatively correlated before the Great Recession, but positively correlated during and after it. The co-variations of the unemployment rate with the rate of self-employment (Figure 2b) corroborates that impression.

3.3 Aggregate rates by education group

In this section we present the aggregate series discussed previously separately for each of the two education groups defined above, i.e. secondary education (A-levels) or above, *vs* less than A-levels. All of the rates presented below are calculated separately for each group. So, for example, the total employment rate for the low education sub-sample is equal to the (weighted) total number of low-educated individuals in employment or self-employment divided by the (weighted) total low-education population. Figure 3 shows that the share of the UK working age population who completed secondary education increases steadily over our observation window from a little over 40% to about 65%. Reassuringly, there is no break in that series around the BHPS/UKHLS changeover period, suggesting that our classification of the workforce into high and low education groups is consistent across data sets.

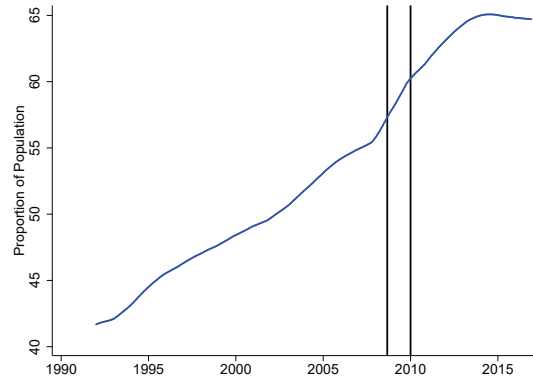
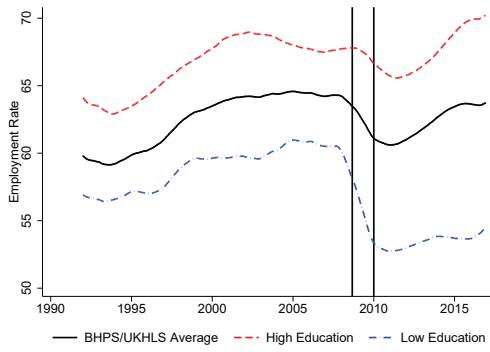
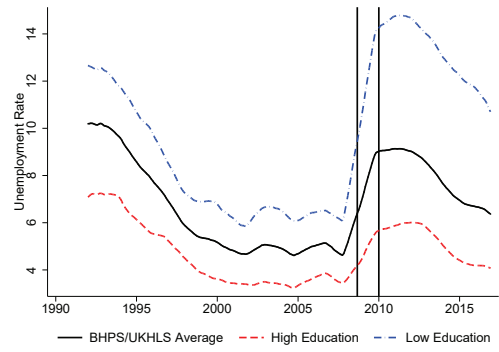


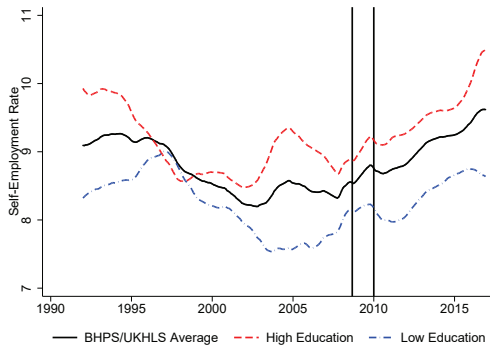
Figure 3: Proportion of sample in high-education group



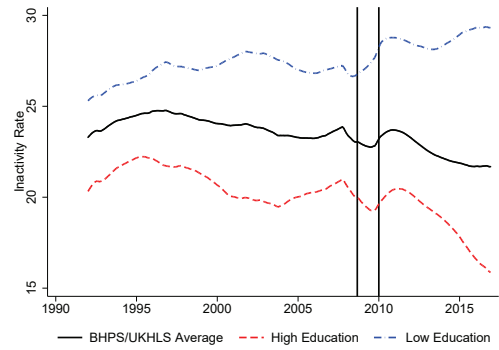
(a) Employment rate



(b) Unemployment rate

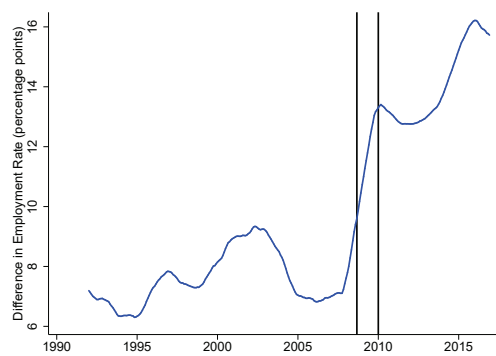


(c) Self-employment rate

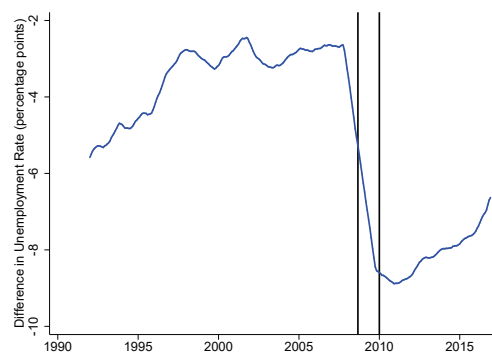


(d) Inactivity rate

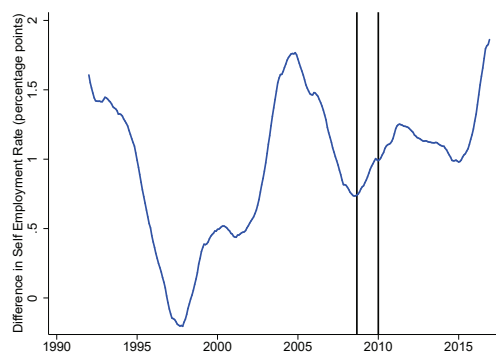
Figure 4: Aggregate monthly rates by education group



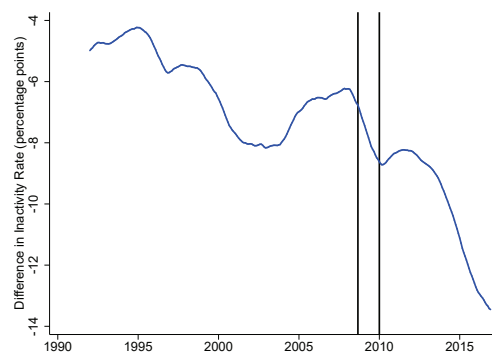
(a) Employment Rate



(b) Unemployment Rate



(c) Self-employment Rate



(d) Inactivity Rate

Figure 5: Aggregate monthly rates: differences across education groups

Figure 4 then shows the (paid) employment, unemployment, self-employment and inactivity rates for both education groups and Figure 5 shows differences in those same rates across education groups. Both figures suggest that those education groups experienced very different changes in labour market conditions, especially following the Great Recession, as we now discuss.

Upon first inspection, Figures 4 and 5 clearly show that, over the sample period, the high-education group had consistently higher employment and self-employment rates and lower inactivity and unemployment rates than the low-education group (although self-employment amongst the high-educated dropped slightly below the economy’s average for a brief period in the late 1990s). Apart from those differences in levels, those rates followed different time profiles between the two education groups, especially around and after the Great Recession.

Employment, unemployment and inactivity. Pre-recession, i.e. over the 1990s and most of the 2000s, the employment rates of both groups followed roughly parallel time profiles, even though the employment rate of the high-educated may be argued to have grown very slightly faster over that period (Figure 5a). Over that same period, the unemployment rate declined monotonically for both groups (Figure 4b), although, perhaps surprisingly, it did so somewhat faster for the *low-education* group, especially during the 1990s (Figure 5b). Mirroring the relative increase in the high-education group’s employment and unemployment rates, inactivity rates diverged somewhat between the two groups over the pre-recession period: inactivity amongst the high-educated declined slightly from around 21-22% in the early 1990s to around 20% at the onset of the Great Recession, while it increased amongst the low-educated over the same period from around 25% to slightly above 26% (Figure 4d). As a result, the cross-group difference in inactivity rates, although somewhat volatile, declined on a trend (Figure 5a).

The Great Recession then appears to have broken those steady trends. While the recession had the expected effect of cutting employment rates and increasing unemployment rates for both groups (Figures 4a and 4b), it did so much more severely for the low-education group (Figures 5a and 5b). By the beginning of 2016, the employment rate of the high-education group was essentially back to its pre-recession levels, whereas that of the low-education group was still about 5 percentage points below its pre-recession level, showing signs of a somewhat anaemic recovery. As for inactivity, while the recession appears to have had little impact on the inactivity rate of the high-educated (if anything, inactivity dropped a little for that group during the recession), it seems to have pushed a sizeable fraction of the low-educated workforce into inactivity (Figure 4d), thus corroborating the downward trend in the cross-group difference in inactivity rates (Figure 5d).

Self-employment. Two things are striking about the self-employment rates of our two education groups. First, self-employment was on a slightly declining trend for both groups in the pre-recession period, and the Great Recession appears to have coincided with a reversal of that trend for both groups

(Figure 4c). Second, the cross-group difference in self-employment rates, while somewhat volatile, does not appear to have any trend, nor to have been affected in any substantial way by the Great Recession.

Taking stock. Taken together, all panels of Figures 4 and 5 suggest that the Great Recession hit the jobs of workers with low education the hardest. The difference in employment rates between the high- and low-education groups, which was relatively stable around 7 percentage points in the run-up to the Great Recession, soared during the Recession and has remained high ever since (Figure 5a). By the beginning of 2016, that difference was around 15 percentage points, roughly double its pre-recession level.

(Salaried) jobs lost among the low-education group seem to have translated into a mix of higher inactivity rates, higher unemployment, and a remarkable rise in self-employment. By contrast, the parallel rise in self-employment amongst high-educated workers appears to have been fuelled by a drop in inactivity rates rather than by a drop in salaried employment or unemployment.

4 Transition Rates

4.1 Preliminary remarks

In this section we document the labour market flows into and out of employment, self-employment, unemployment and inactivity. We calculate transition rates by first identifying and classifying all transitions. For example we record the occurrence of a transition from unemployment to employment if (1) the respondent was unemployed in $t - 1$ and employed at t and (2) the respondent reports that they started a new employment spell in month t . We then calculate the weighted sum of each transition type in each month, using the cross-sectional weights supplied with BHPS and UKHLS.

We label all transitions in accordance with our notation for the stocks: for example, the aggregate number of transitions from unemployment to employment transition in month t is denoted as UE_t . Transitions from unemployment to work, irrespective of self- vs. salaried employment, will be denoted as UW_t . Note that workers often change jobs without experiencing any interim period of non-employment, giving rise to employment-to-employment (EE_t) and self-employment-to-self-employment transitions (SS_t). Job-to-job transitions, irrespective of self- vs. salaried employment, will be denoted as WW_t .

Finally, we construct the transition rate in each month t following the method suggested by Shimer (2012). For example, we calculate the UW transition rate as $\lambda_t^{UW} = -\ln\left(1 - \frac{UW_t}{U_{t-1}}\right)$. In what follows, we will refer to λ_t^{UW} as the job finding rate and to $\frac{UW_t}{U_{t-1}}$ as the job finding probability. This is the probability of a worker starting period t unemployed finds at least one job during the period. Other transition rates and probabilities are defined similarly.

4.2 Aggregate transition rates: work, unemployment and inactivity

We begin by focusing attention on transitions between work, unemployment and inactivity. Unfortunately, the ONS does not produce series of aggregate transition rates against which we could benchmark our own estimates, as we did for labour market stocks in the previous section. However, Smith (2011) produced aggregate transition rate series based on BHPS data over the period 1990-2008.⁸ We will use Smith's series as our benchmark for comparison.

Transitions in and out of work. Figure 6 shows the six series of transition rates between work, unemployment and inactivity.⁹ Overall, the levels and trends of our transition rate series are very similar to those constructed by Smith (2011) over the period covered by Smith's series.¹⁰ However, our unemployment to work (UW) transition rate (Figure 6b) is consistently lower than Smith's, and our inactivity to work (IW, Figure 6d) and inactivity to unemployment (IU, Figure 6d) series are consistently higher than hers. These differences are likely caused by our different way of defining employment statuses, especially inactivity. In Smith's definition, inactivity includes retirement, family care, long-term sickness or disability, full-time education, national or war service and "anything else" (approximately 32% of her sample). By contrast, we also require individuals to have not searched for work or claimed unemployment benefits in the four weeks prior to their interview. This narrower definition of inactivity results in lower average inactivity rates compared to Smith (2011) (around 24% of our sample) and higher transition rates from inactivity to unemployment and work.

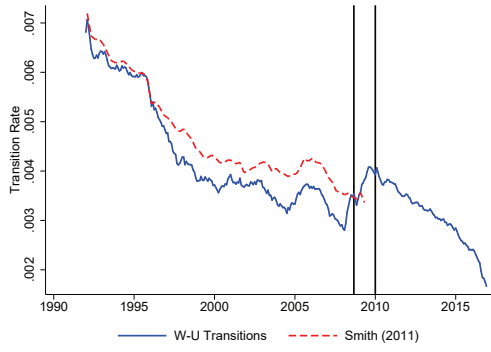
The dividing line between inactivity and unemployment is inevitably somewhat arbitrary. We chose our definitions of unemployment and inactivity on two grounds. First, our definitions are closer to those upon which the ONS bases its own aggregate labour market series. Since those ONS series are the reference measures of employment and unemployment rates in the UK, it is important that our own series match those measures. Second, while Smith's IW transition rates (Figure 6f) stayed roughly constant around 0.2% up until 2008, our series have a downward trend from 1992 to 2008 followed by a sharp increase during the Great Recession, which is consistent with the findings of Elsby, Michaels, and Solon (2009) that IU transitions intensify during downturns.

The behaviour of our various transition rates over the observation window is in line with what was documented elsewhere in the literature. The UW rate (Figure 6b) increased from the end of the 1992 recession to a peak of around of 7.5% at the beginning of 2000. It then started a gradual decline,

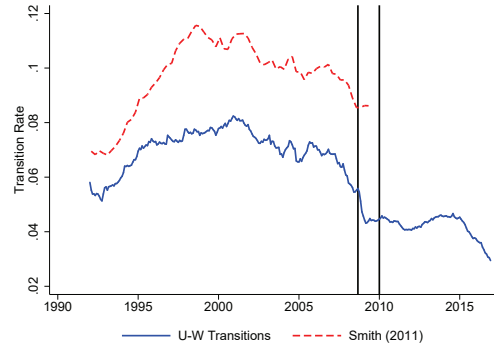
⁸These transition rates are available at sites.google.com/site/jcsmithecon/data.

⁹As is evident from this and from subsequent figures showing transition rate series, estimated transition rates tend to drop very sharply in the final few months of our sample window. This drop is mostly attributable to the increasing sparsity of data as one approaches the final date of the sample (see the description of the structure of UKHLS in Section 2). In particular, it keeps getting knocked back to the very end of the sample window as new waves are added to UKHLS. As such, it should not be taken as economically meaningful.

¹⁰The data provided by Smith are quarterly, while we have constructed monthly series. We have plotted Smith's estimates transition rates in the middle month of the corresponding quarter. Moreover, Smith mentions that she has applied seasonal adjustment to her transition rates, whereas we haven't.



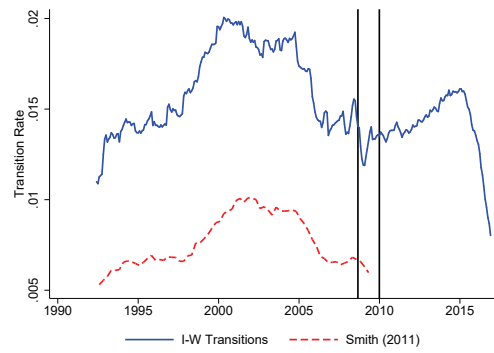
(a) Work to Unemployment



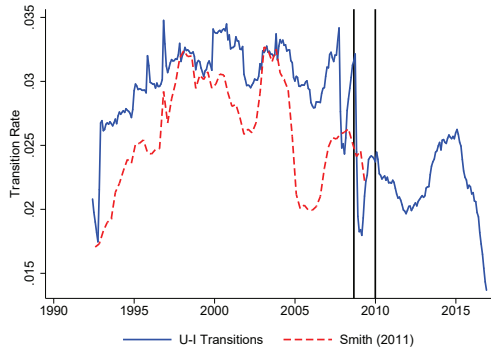
(b) Unemployment to Work



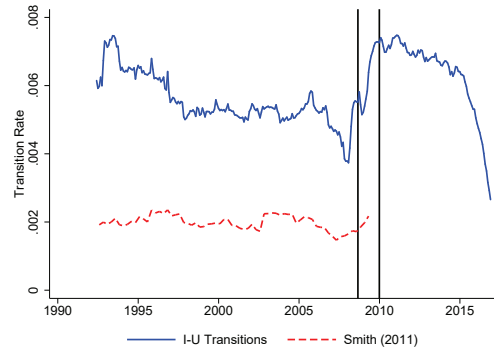
(c) Work to Inactivity



(d) Inactivity to Work



(e) Unemployment to Inactivity



(f) Inactivity to Unemployment

Figure 6: Separation and job finding rates

followed by a sharp drop towards the end of 2008, from which it has yet to recover. The IW rate (Figure 6d) follows a qualitatively similar pattern.

The WU job separation rate peaked at 0.7% in the 1992 recession, after which it declined steadily until 2008. It then increased sharply and suddenly during the Great Recession, but quickly resumed its trend decline after 2010, down to a low of around 0.25% since 2014. By contrast, the WI rate (Figure 6c) was hump-shaped over the period 1992-2008, reaching its peak around 2001. But during and after the Great Recession, the WI rate evolved roughly parallel to the WU rate.

Finally, the UI transition rate (Figure 6f) stayed around 3%, albeit on a very slight upward trend, from 1992-2008 before falling sharply during the Great Recession. It has since then stayed lower than its pre-recession level at around 2%. As discussed above, the IU rate mirrored the UI rate qualitatively, although with quantitatively larger swings.

Job-to-job mobility. Figure 7 plots our job-to-job (WW) transition rate series, i.e. the rate at which either employed or self-employed workers move directly from one job to another without experiencing any period of unemployment or inactivity in between.

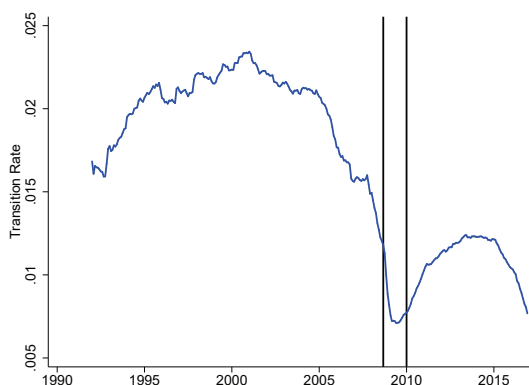


Figure 7: Job-to-job transition rate

The behaviour of the WW rate over our observation window is qualitatively similar to that of the UW rate (Figure 6b): increasing in the 1990s, reaching a peak around 2000, then gradually declining until 2008 to its early-1990s level, before falling sharply during the Great Recession and staying at historically low levels ever since. Quantitatively, however, the drop in the WW rate during the Great Recession is, in relative terms, much more dramatic than the drop in UW rates.

Taking stock. One consistent message conveyed by Figures 6 and 7 is that all of the transition rates in and out of work (WU, UW, WW, WI, and, to a slightly lesser extent, IW) have been on a downward trend since around 2000. This echoes similar findings for the US (see, among others, Fallick and Fleischman, 2004, Fujita, Moscarini, and Postel-Vinay, 2018), which have fuelled a literature investigating a possible trend decline in business dynamism. The US decline in transition rates is

generally accepted to have started in the early to mid-1990s, slightly earlier than what our data suggest for the UK. Yet the parallel is striking.

4.3 Transitions in and out of self-employment

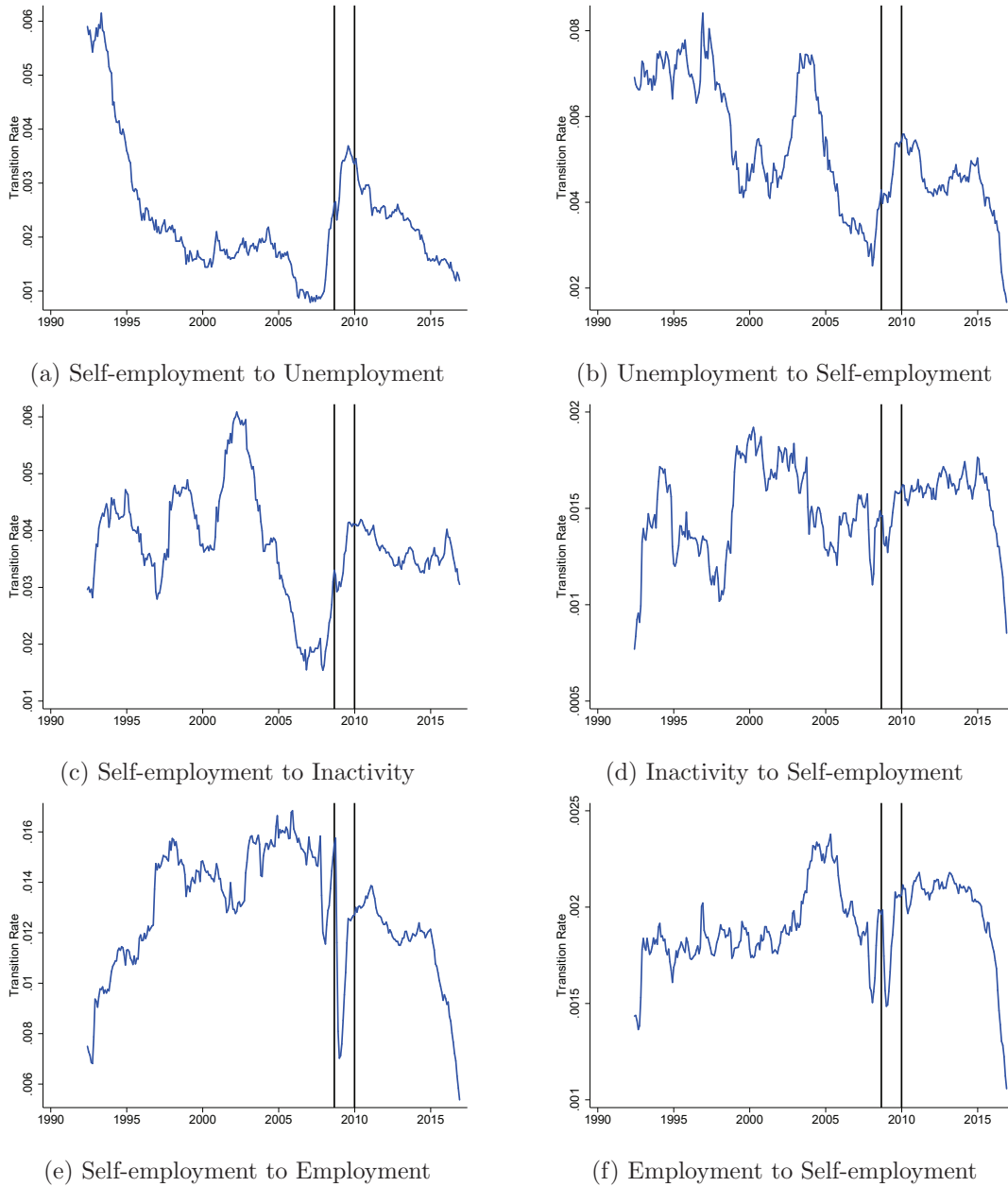


Figure 8: Self-employment transition rates

We next turn to transitions involving self-employment, with Figure 8 showing all transition rates into and out of self-employment. Transition rates between self-employment and unemployment (SU and

US rates, Figures 8a and 8b) evolve in a qualitatively similar way to their WU and UW counterparts rates (Figures 6a and 6b). In particular, the SU and US rates both trend down over most of the observation window, even though the decline in SU and US rates appears to have started a few years earlier than the corresponding decline in WU and UW rates. Another difference is that the US rate is more volatile than the UW rate, showing a few sizeable spikes, notably one towards the end of the Great Recession.

Transition between self-employment and inactivity (Panels 8c and 8d), although somewhat volatile, show no particular trend over the period considered.

Finally, Panels 8e and 8f show transition rates between self-employment and employment. The SE rate is hump-shaped over the pre-recession period, much like the general WW rate (Figure 7) but, unlike the WW rate, it does not collapse during the Great Recession: rather, it seems to have started on a slow downward trend around 2008. As for the ES rate, it has been on a slow but steady upward trend since the start of the sample.

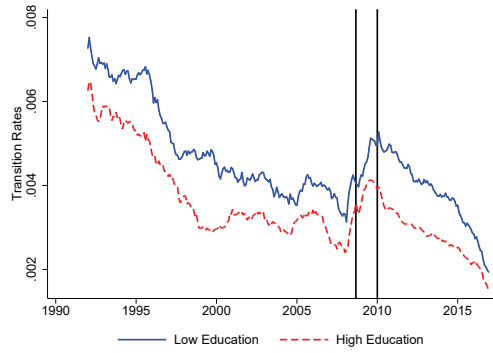
Summing up, the U-shape of the self-employment rate over period 1992-2016 documented on Figure 1c results from a somewhat complex combination of various inflows and outflows: a fall in transitions from unemployment into self-employment, partly compensated by fewer transitions into unemployment and by more transitions from employment. Zooming in on the aftermath of the Great Recession, a period during which the self-employment rate has increased in the UK (Figure 1c), we can see that this increase in the stock of self-employed workers came with increased “impermeability” of the state of self-employment, i.e. with a fall in all of the associated inflow and outflow rates. Yet clearly, over that period, the impact of the combined fall in outflow rates from self-employment into unemployment, inactivity, and employment dominated the contemporaneous fall in inflow rates.

4.4 Transition rates by education

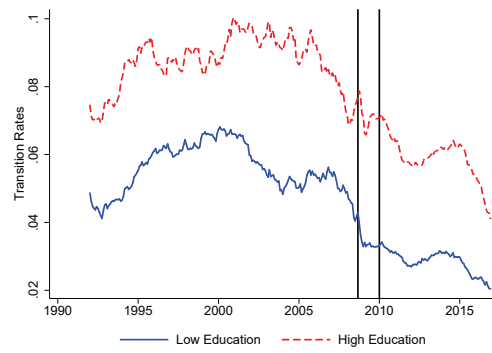
Figures 9, 10 and 11 show various transition rates broken down by education group. We should note that some of those series, especially those pertaining to transitions between unemployment and inactivity, are very noisy, owing to the small number of such transitions typically sampled.

Transitions in and out of work. Figure 9 replicates Figure 6 for each of our two education groups. Unsurprisingly, highly educated workers have consistently higher UW and lower WU transition rates than low-education workers. IW rates are also consistently higher for the high-education group but, perhaps more surprisingly, both groups have similar WI rates. Overall, transition rates between unemployment and inactivity are similar in levels between the two groups. The large relative drop in the inactivity rate of the high-education group (Figure 4d) can thus be traced back, for the most part, to differences in transitions into work from inactivity.

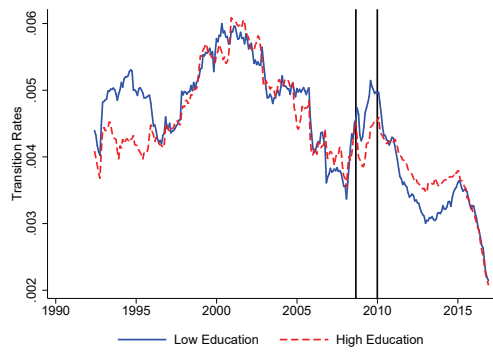
The gap between the two groups in terms of transition rates does not appear to be narrowing or widening over time to any substantial extent (see Figure 17 in Appendix B) with the notable exception



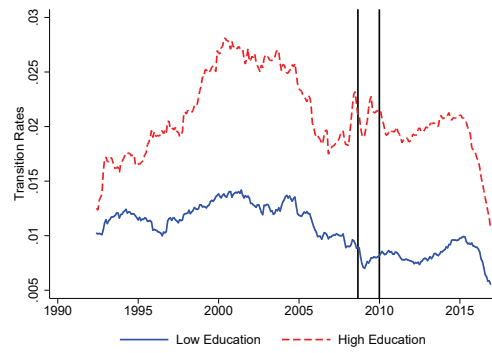
(a) Work to Unemployment



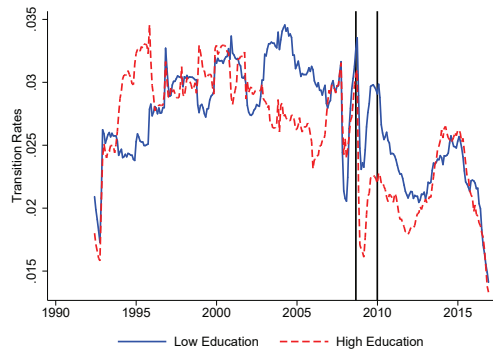
(b) Unemployment to Work



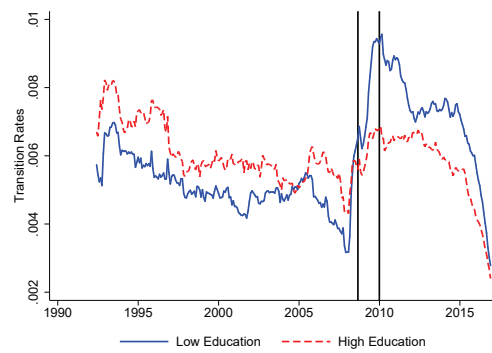
(c) Work to Inactivity



(d) Inactivity to Work



(e) Unemployment to Inactivity



(f) Inactivity to Unemployment

Figure 9: Separation and job finding rates by education group

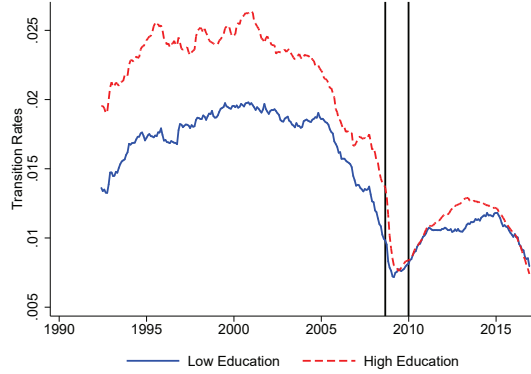


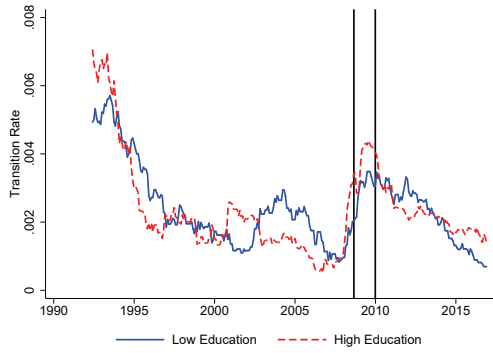
Figure 10: Job-to-job transition rate by education level

of the IW rate, which increased for the high-education group relative to the low-education group over the 1990s and stayed flat thereafter (the cross-group difference went from +0.25 percentage point in the mid 1990s to +1 percentage point since the beginning of the 2000s). Despite that difference, it can be argued that the aggregate trend decline in transition rates in and out of work noted earlier affected both education groups to roughly similar extents.

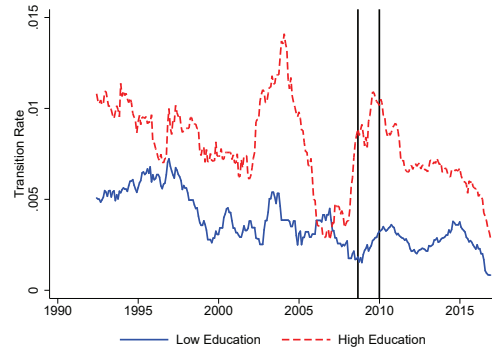
Job-to-job transitions. Figure 10 reports job-to-job transition rates for both education groups. While the two series have similar time profiles, the low-education group had markedly lower rates of job-to-job mobility up until 2008, after which the two series converge to a large extent. In terms of job-to-job mobility rates, the education gap seems to have been closing around the time of the Great Recession, and showed little sign of reopening after that.

Transitions in and out of self-employment. Finally, Figure 11 shows transition rates to and from self-employment by education group. Those particular series contain a considerable amount of noise, due to small sample sizes, which makes their interpretation somewhat fragile. Yet, one can see that self-employment outflow rates into either unemployment (Figure 11a) or inactivity (Figure 11c) are very close between the two groups over the entire observation window. The third outflow rate, from self-employment to employment, is slightly higher for the high-education group over the 1995-2005 decade (Figure 11e), but otherwise also similar between the two groups. Therefore, the difference in self-employment rates between the two groups (Figure 4c) has to be explained by different inflow rates. Indeed, the high-education group have consistently higher US and IS rates than the low-education group. The same is true up until 2005 of the cross-group difference in ES rates, after which ES rates seem to have converged between the two groups. It can thus be concluded that the high-education group experiences higher turnover in and out of self-employment than the low-education group, albeit with a more favourable inflow/outflow balance.

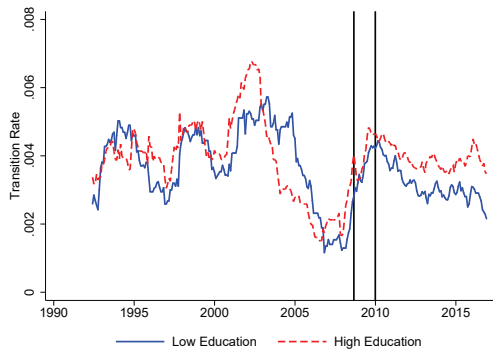
Finally, a look at the differences in those rates across the two education groups (Figure 18 in



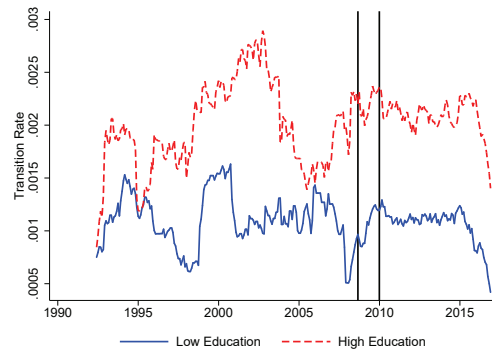
(a) Self-employment to Unemployment



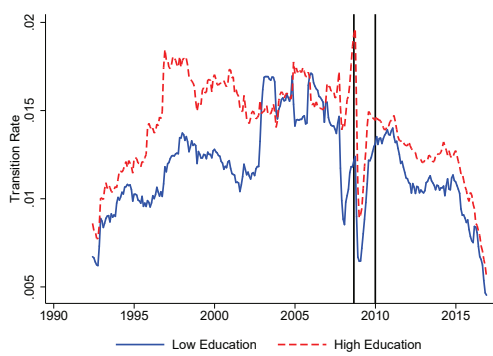
(b) Unemployment to Self-employment



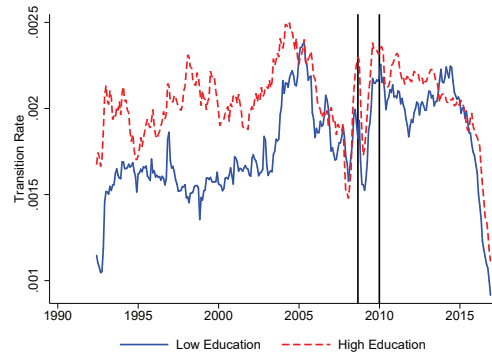
(c) Self-employment to Inactivity



(d) Inactivity to Self-employment



(e) Self-employment to Employment



(f) Employment to Self-employment

Figure 11: Self-employment transition rates by education level

Appendix B) reveals no particular trend, with two exceptions: a small upward trend in the (high- to low-education) relative IS flow rate, and a downward trend in the relative ES flow rate. This is consistent with the conclusion reached before: while the incidence of self-employment increased in parallel for both education groups since the beginning of the Great Recession, the counterpart to that increase was a decline in inactivity rates for the high-educated, and a (relative) decline in paid employment for the low-educated.

4.5 The “ins and outs of unemployment”: a reassessment

In this section we revisit the question asked by, among others, Petrongolo and Pissarides (2008), Fujita and Ramey (2009), Elsby, Michaels, and Solon (2009), Shimer (2012), and Smith (2011), of whether the dynamics of unemployment are principally driven by inflows or outflows, and more specifically by which inflow(s) or outflow(s). Most of the studies asking that question rely on a two-state model (i.e. a model where workers are either employed or unemployed) to decompose the variance of changes in unemployment into a share due to inflows and a share due to outflows. Smith (2011) extends that model to allow for a third state, inactivity, which allows her to assess the separate contributions of flows between unemployment and employment and flows between inactivity and unemployment. We further extend Smith’s model to distinguish between two different “employment” states: paid employment and self-employment.

A three-state model (Smith, 2011). Smith (2011) considers flows between three different labour market states: employment (W), unemployment (U), and inactivity (I). Denoting the period- t transition probability between states s and s' by $\lambda_t^{ss'}$, changes in employment, unemployment, and inactivity result from the following combination of flows:

$$\begin{aligned} U_{t+1} - U_t &= \lambda_t^{WU} W_t + \lambda_t^{IU} I_t - (\lambda_t^{UW} + \lambda_t^{UI}) U_t \\ W_{t+1} - W_t &= \lambda_t^{UW} U_t + \lambda_t^{IW} I_t - (\lambda_t^{WU} + \lambda_t^{WI}) W_t \\ I_{t+1} - I_t &= \lambda_t^{UI} U_t + \lambda_t^{WI} W_t - (\lambda_t^{IU} + \lambda_t^{IW}) I_t \end{aligned} \tag{1}$$

Smith (2011) then goes on to establish that the predicted steady-state unemployment rate, given current transition probabilities $\lambda_t^{ss'}$, is:¹¹

$$\bar{u}_t = \frac{\lambda_t^{WU} + \frac{\lambda_t^{WI} \lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IW}}}{\lambda_t^{WU} + \frac{\lambda_t^{WI} \lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IW}} + \lambda_t^{UW} + \frac{\lambda_t^{UI} \lambda_t^{IW}}{\lambda_t^{UI} + \lambda_t^{WI}}} \tag{2}$$

The first term in the numerator reflects direct transitions from employment to unemployment. The second term in the numerator reflects transitions into unemployment through inactivity: it is the

¹¹This is obtained by setting the three left-hand sides in (1) to zero, then solving for $\bar{u}_t = U_t/(W_t + U_t)$.

product of direct transitions from employment to inactivity by the share of outflows from inactivity that goes to unemployment. Smith (2011) interprets this as the likelihood of transitions from employment to inactivity to unemployment. Likewise, the third term in the denominator reflects direct transitions from unemployment to employment, while the fourth term reflects indirect transitions through inactivity.

Self-employment in a four-state model. We now extend Smith's three-state model to allow for a distinction with employment (W) between paid employment (E) and self-employment (S), such that $W = E + S$. We now have a four-state model (U, E, S, I); again denoting transition probabilities between the various states by $\lambda_t^{ss'}$, changes in the various stocks are given by the following flow-balance equations:

$$\begin{aligned} U_{t+1} - U_t &= \lambda_t^{EU} E_t + \lambda_t^{IU} I_t + \lambda_t^{SU} S_t - (\lambda_t^{UE} + \lambda_t^{US} + \lambda_t^{UI}) U_t \\ E_{t+1} - E_t &= \lambda_t^{UE} U_t + \lambda_t^{IE} I_t + \lambda_t^{SE} S_t - (\lambda_t^{EU} + \lambda_t^{EI} + \lambda_t^{ES}) E_t \\ S_{t+1} - S_t &= \lambda_t^{ES} E_t + \lambda_t^{US} U_t + \lambda_t^{IS} I_t - (\lambda_t^{SE} + \lambda_t^{SU} + \lambda_t^{SI}) S_t \\ I_{t+1} - I_t &= \lambda_t^{UI} U_t + \lambda_t^{EI} E_t + \lambda_t^{SI} S_t - (\lambda_t^{IU} + \lambda_t^{IE} + \lambda_t^{IS}) I_t \end{aligned} \tag{3}$$

We now define the following weighted flow rates (recalling that $W_t = E_t + S_t$):

$$\begin{aligned} \bar{\lambda}_t^{EU} &= \lambda_t^{EU} \frac{E_t}{W_t} & \bar{\lambda}_t^{SU} &= \lambda_t^{SU} \frac{S_t}{W_t} \\ \bar{\lambda}_t^{EI} &= \lambda_t^{EI} \frac{E_t}{W_t} & \bar{\lambda}_t^{SI} &= \lambda_t^{SI} \frac{S_t}{W_t} \end{aligned}$$

Combining the middle two equations in (3), we obtain:

$$\begin{aligned} U_{t+1} - U_t &= (\bar{\lambda}_t^{EU} + \bar{\lambda}_t^{SU}) W_t + \lambda_t^{IU} I_t - (\lambda_t^{UE} + \lambda_t^{US} + \lambda_t^{UI}) U_t \\ W_{t+1} - W_t &= (\lambda_t^{UE} + \lambda_t^{US}) U_t + (\lambda_t^{IE} + \lambda_t^{IS}) I_t - (\bar{\lambda}_t^{EU} + \bar{\lambda}_t^{SU} + \bar{\lambda}_t^{EI} + \bar{\lambda}_t^{SI}) W_t \\ I_{t+1} - I_t &= \lambda_t^{UI} U_t + (\bar{\lambda}_t^{EI} + \bar{\lambda}_t^{SI}) W_t - (\lambda_t^{IU} + \lambda_t^{IE} + \lambda_t^{IS}) I_t \end{aligned}$$

which is formally identical to Smith's model (1). Therefore, by analogy with Smith's derivation:¹²

$$\bar{u}_t = \frac{\bar{\lambda}_t^{EU} + \bar{\lambda}_t^{SU} + \frac{(\bar{\lambda}_t^{EI} + \bar{\lambda}_t^{SI}) \lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE} + \lambda_t^{IS}}}{\bar{\lambda}_t^{EU} + \bar{\lambda}_t^{SU} + \frac{(\bar{\lambda}_t^{EI} + \bar{\lambda}_t^{SI}) \lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE} + \lambda_t^{IS}} + \lambda_t^{UE} + \lambda_t^{US} + \frac{\lambda_t^{UI} (\lambda_t^{IE} + \lambda_t^{IS})}{\lambda_t^{UI} + \bar{\lambda}_t^{EI} + \bar{\lambda}_t^{SI}}} \tag{4}$$

The interpretation is similar to that of the three-state model of Smith (2011). The terms $\bar{\lambda}_t^{EU}$ and $\bar{\lambda}_t^{SU}$ in the numerator reflect direct transition into unemployment from, respectively, paid employment

¹²Computation of \bar{u}_t using (4) requires prior computation of the predicted steady-state paid employment and self-employment shares, E_t/W_t and S_t/W_t , which enter the definitions of the various $\bar{\lambda}_t^{ss'}$. This can be done by solving (3) in steady state, which yields (inter alia) the predicted steady-state levels of E_t and S_t as functions of the various flow probabilities $\lambda_t^{ss'}$. Details are available upon request.

and self-employment. The third term in the numerator reflects transitions into unemployment through inactivity. The interpretation is again similar for the last three terms in the denominator.

Decomposing the variance of \bar{u}_t . Following Petrongolo and Pissarides (2008) we are interested in decomposing the variance of changes in the predicted steady-state unemployment rates over time. To this end, we first introduce the additional space-saving notation:

$$\bar{\lambda}_t^{IU} = \frac{(\bar{\lambda}_t^{EI} + \bar{\lambda}_t^{SI}) \lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE} + \lambda_t^{IS}} \quad \text{and} \quad \bar{\lambda}_t^{UI} = \frac{\lambda_t^{UI} (\lambda_t^{IE} + \lambda_t^{IS})}{\lambda_t^{UI} + \bar{\lambda}_t^{EI} + \bar{\lambda}_t^{SI}}$$

The definition (4) of \bar{u}_t now writes as:

$$\bar{u}_t = \frac{\bar{\lambda}_t^{EU} + \bar{\lambda}_t^{SU} + \bar{\lambda}_t^{IU}}{\bar{\lambda}_t^{EU} + \bar{\lambda}_t^{SU} + \bar{\lambda}_t^{IU} + \lambda_t^{UE} + \lambda_t^{US} + \bar{\lambda}_t^{UI}} \quad (5)$$

A log-linear approximation of $\Delta \bar{u}_t = \ln \bar{u}_t - \ln \bar{u}_{t-1}$ based on (5) yields:

$$\begin{aligned} \Delta \bar{u}_t = & \underbrace{\frac{(1 - \bar{u}_{t-1}) \bar{\lambda}_{t-1}^{EU}}{\bar{\lambda}_{t-1}^{EU} + \bar{\lambda}_{t-1}^{SU} + \bar{\lambda}_{t-1}^{IU}} \Delta \bar{\lambda}_t^{EU}}_{:= \Lambda_t^{EU}} + \underbrace{\frac{(1 - \bar{u}_{t-1}) \bar{\lambda}_{t-1}^{SU}}{\bar{\lambda}_{t-1}^{EU} + \bar{\lambda}_{t-1}^{SU} + \bar{\lambda}_{t-1}^{IU}} \Delta \bar{\lambda}_t^{SU}}_{:= \Lambda_t^{SU}} + \underbrace{\frac{(1 - \bar{u}_{t-1}) \bar{\lambda}_{t-1}^{IU}}{\bar{\lambda}_{t-1}^{EU} + \bar{\lambda}_{t-1}^{SU} + \bar{\lambda}_{t-1}^{IU}} \Delta \bar{\lambda}_t^{IU}}_{:= \Lambda_t^{IU}} \\ & - \underbrace{\frac{(1 - \bar{u}_{t-1}) \lambda_{t-1}^{UE}}{\lambda_{t-1}^{UE} + \lambda_{t-1}^{US} + \bar{\lambda}_{t-1}^{UI}} \Delta \lambda_t^{UE}}_{:= -\Lambda_t^{UE}} - \underbrace{\frac{(1 - \bar{u}_{t-1}) \lambda_{t-1}^{US}}{\lambda_{t-1}^{UE} + \lambda_{t-1}^{US} + \bar{\lambda}_{t-1}^{UI}} \Delta \lambda_t^{US}}_{:= -\Lambda_t^{US}} - \underbrace{\frac{(1 - \bar{u}_{t-1}) \bar{\lambda}_{t-1}^{UI}}{\lambda_{t-1}^{UE} + \lambda_{t-1}^{US} + \bar{\lambda}_{t-1}^{UI}} \Delta \bar{\lambda}_t^{UI}}_{:= -\Lambda_t^{UI}} \end{aligned}$$

so that $\text{Var}(\Delta \bar{u}_t)$ can be decomposed into the contributions of each inflow and outflow as follows:

$$\begin{aligned} \text{Var}(\Delta \bar{u}_t) = & \text{Cov}(\Delta \bar{u}_t, \Lambda_t^{EU}) + \text{Cov}(\Delta \bar{u}_t, \Lambda_t^{SU}) + \text{Cov}(\Delta \bar{u}_t, \Lambda_t^{IU}) \\ & + \text{Cov}(\Delta \bar{u}_t, \Lambda_t^{UE}) + \text{Cov}(\Delta \bar{u}_t, \Lambda_t^{US}) + \text{Cov}(\Delta \bar{u}_t, \Lambda_t^{UI}) \end{aligned}$$

We follow Smith (2011) in defining the variance share of each flow ss' as $\text{Cov}(\Delta \bar{u}_t, \Lambda_t^{ss'}) / \text{Var}(\Delta \bar{u}_t)$, for $ss' \in \{EU, SU, IU, UE, US, UI\}$.

Results. Table 1 shows the results from our decomposition of the variance of unemployment changes into the contributions of various flow rates. Specifically, we report the contributions of each of the flow rates listed above (EU, SU, IU, UE, US, UI), as well as the total contribution of inflows into unemployment (the sum of the shares of EU, SU and IU transitions) and the total contribution of all unemployment outflows (the sum of the shares of UE, US and UI transitions) in the first two rows of the table. As such, the format of our Table 1 mimics that of Smith's (2011) Table 1. We further report results for the whole sample (Column 1), and for each education sub-sample (Columns 2 and 3).

We first focus on our results for the whole sample (Column 1). Overall, 56% of the variance of $\Delta \bar{u}_t$

Table 1: Contributions of various flow rates to changes in unemployment, 1992m3 - 2015m12

Variance share of...	Whole sample	Low education	High education
total inflows	0.568 (0.035)	0.590 (0.028)	0.585 (0.035)
total outflows	0.425 (0.034)	0.399 (0.028)	0.408 (0.034)
EU transitions	0.394 (0.027)	0.389 (0.023)	0.436 (0.031)
SU transitions	0.046 (0.007)	0.022 (0.006)	0.052 (0.010)
IU transitions	0.130 (0.018)	0.178 (0.016)	0.103 (0.017)
UE transitions	0.378 (0.027)	0.373 (0.024)	0.362 (0.028)
US transitions	0.007 (0.009)	0.0009 (0.009)	0.006 (0.011)
UI transitions	0.059 (0.010)	0.038 (0.007)	0.053 (0.011)

Standard errors in parentheses

is explained by changes in unemployment inflows and 42% by changes in outflows. Those two numbers are remarkably close to the findings of Smith (2011), despite differences in time periods (notably the fact that our observation window covers the Great Recession, at time of great volatility in transition rates) and despite slight differences in our handling of the raw data. Within the 56% explained by total inflows, EU transitions account for almost 39%, and IU transitions for about 13%. Both of those numbers are slightly lower than Smith's (respectively 41% and 16%). There are two likely causes for those differences: our different definition of inactivity (see the discussion in Sub-section 4.2) and the fact that we report a separate contribution of flows between unemployment and self-employment. Indeed we find that the inflow from self-employment (SU) accounts for 4.6% of the variance in unemployment changes.

On the unemployment outflow side, we find that UE transitions explain 37.8% of unemployment dynamics, with the remaining 5.9% almost entirely explained by UI transitions (the share of US transitions is negligible). By contrast, Smith (2011) finds a somewhat higher share of UI transitions (9%) and a lower share of UE transitions (31%).

We next turn to a comparison of our variance decomposition between education groups (Columns 2 and 3 of Table 1). For both groups, inflows matter more than outflows, as is the case at the aggregate level. Moreover, the relative share of unemployment inflows is similar between education groups (59% vs 58.5%, those numbers being well within a standard deviation of each other).

Further decomposing into specific flows, a more complex picture emerges. EU and UE transitions account for shares of the variance in unemployment changes that are large and similar (between 37% and 44%, the high-education EU inflow accounting for a slightly higher variance share than other flows), both within and between education groups. This means that, in total, transitions between unemployment and paid employment account for about three quarters to 80% of changes in unemployment dynamics for both education groups. Differences between those two groups appear in the breakdown of the remaining 25% into the contributions of inactivity *vs* self-employment: for the low-educated group, flows between unemployment and inactivity contribute a total of 21.6% (17.8% IU flows, 3.8% UI flows), and flows between unemployment and self-employment contribute 2.2% (2.2% SU flows and virtually 0% US flows). The corresponding split is 15.6% to 5.8% for the high-education group. While the contribution of flows between unemployment and self-employment is arguably modest for both groups, those numbers still suggest that they are two to three times as important as a driver of unemployment dynamics for the high-education than for the low-education group.

5 Earnings

5.1 Average real labour earnings

We construct series for average monthly labour income as the weighted sum of monthly labour income (using the BHPS and UKHLS cross-sectional weights), divided by the weighted sum of respondents reporting non-zero labour income in month t . This process produces estimates of nominal average labour income in each month t . We then construct real average labour income by deflating nominal labour income to 2015 GBP using the CPI All Items (D7BT) series produced by the ONS. We compare our estimates of real labour earnings to those produced by the ONS as part of its Average Weekly Earnings series (AWE).¹³ When we make this comparison, we take the ONS estimate of nominal earnings and deflate using the same CPI series we use for our own BHPS/UKHLS series.

There is less information available on monthly pay in UKHLS than in BHPS. Monthly labour earnings are only available in UKHLS for any job the respondent holds *at the time of interviewing*. In BHPS, data on labour income is available for the individual’s full employment history, including jobs which were held between the previous and current interviews. For the UKHLS period, we therefore calculate average earnings as the weighted total monthly earnings that we observe, divided by the weighted total of individuals whose labour income we observe — i.e. we ignore individuals who are

¹³As our ONS benchmark, we use the “Weekly Earnings (KAB9)” series, which is part of the ONS’s AWE. AWE is used by the Bank of England and HM Treasury to measure the inflationary pressure emanating from the labour market.

employed but whose labour income we do not observe.¹⁴

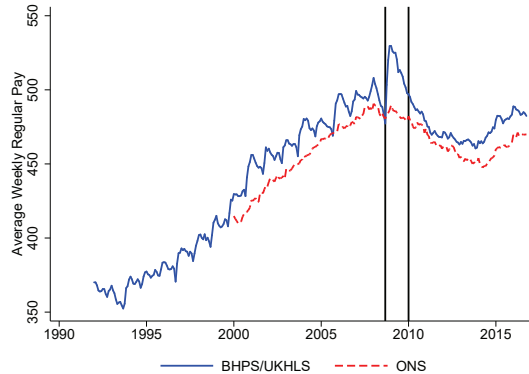


Figure 12: Average real weekly earnings vs. ONS estimates

Figure 12 shows the average real weekly earnings series constructed from BHPS and UKHLS against the corresponding ONS series. The latter is only available from January 2000 onwards. Both series have parallel time profiles, and are very close in level. Nevertheless, on average there is a £10-20 difference (in 2015 GBP) between the two series. This can be explained by the fact that the ONS excludes self-employed workers, the Armed Forces, and government supported trainees from the construction of its series while we include the whole sample in ours.

Our series confirms that, after over 15 years of steady growth, real labour earnings started falling in 2008 and have been very subdued ever since (despite signs of recovery since early 2015), as has been widely documented and discussed in the public debate.

5.2 Self-employment

The self-employed report two distinct sources of earnings in our BHPS/UKHLS data set: pay (excluding profits) and profits. The latter source (profits) is not considered labour earnings by the ONS and as such is not counted in the average weekly labour earnings series shown in Figure 12.

While we also excluded self-employed profits from our own series for comparability, it is worth noting that profits are an important source of self-employed total pay, as shown on Figure 13. The two columns on that figure compare average earnings of employed and self-employed workers in terms of levels (top row) and self-employment premia (bottom row), using different definitions of self-employed earnings, with Figures 13a and 13c excluding self-employed profits and Figures 13b and 13d including them. Based on the series that excludes self-employed profits (Figure 13a), one would conclude that average self-employed earnings were considerably lower than employed earnings, hardly showed any trend at

¹⁴This approach is the same as the one we use for BHPS sample members with missing labour earnings for an employment spell. It implies that we tend to be missing the earnings of highly mobile workers (workers who change jobs often), which are likely to be a selected population. However, these workers represent a very modest fraction of total employment, and their exclusion is unlikely to make any discernible difference to the series plotted in this section.

all over our 1992-2016 window, and were only mildly affected by the Great Recession. Including self-employed profits, however, suggests a radically different story (Figure 13b): self-employed average total pay started out about 10% higher than average employed earnings, grew over the pre-recession period (albeit a little slower than average earnings), and fell even more sharply than average earnings during the Great Recession. In other words, most of the action in self-employed average earnings was driven by self-employed profits, which fell dramatically during the Great Recession and had not fully recovered from that fall by the beginning of 2016.

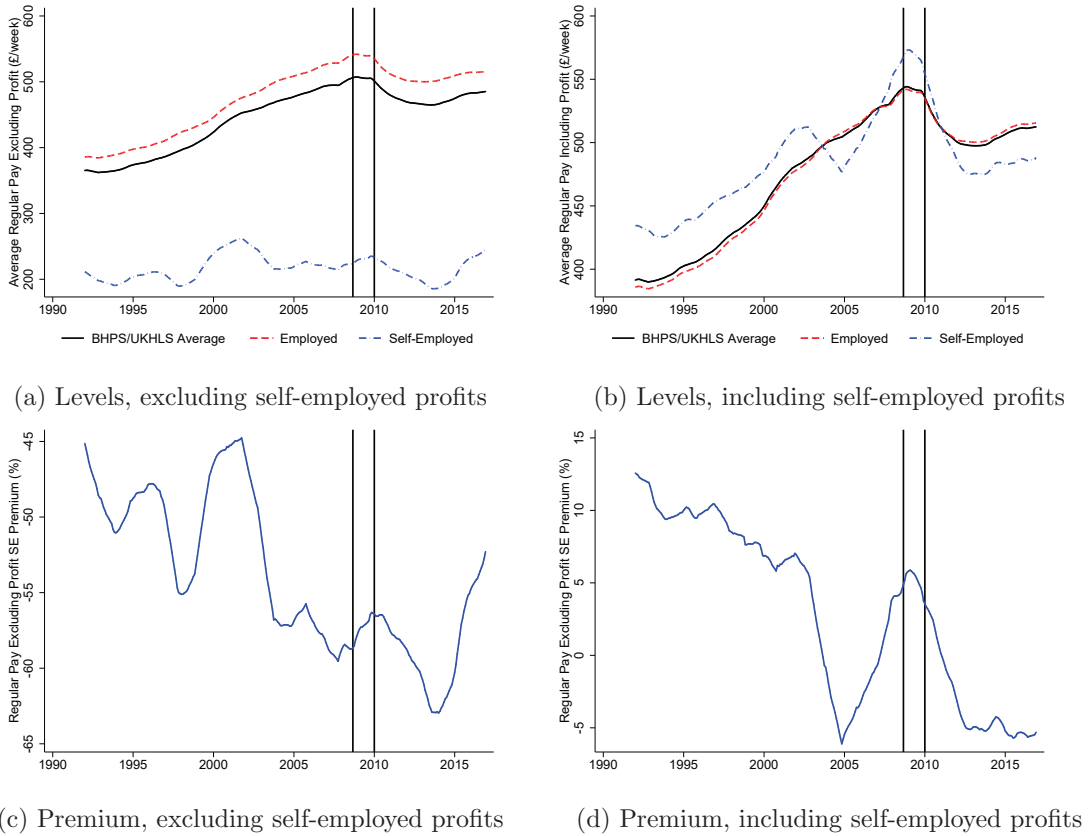


Figure 13: Self-employed vs. employed earnings

Variations in self-employed profits over time, including the sudden and sharp fall during the Great Recession should be interpreted with caution. Not all self-employed report profits, and whether self-employed pay is reported as profits or some other form of earnings is, to an extent, an accounting choice.¹⁵ Said choice may be driven by factors correlated with the business cycle, or by changes in the tax system. Still, the relative stability of self-employed pay excluding profits contrasts sharply with the volatility of profits, and the total self-employed pay series suggests that overall, the self-employed were strongly affected by the Great Recession, even more so than the employed. Perhaps even more

¹⁵We treat profit as zero when calculating total pay and profit is missing — this is consistent with BHPS/UKHLS treatment of total pay.

strikingly, whatever measure of self-employed pay one considers, Figures 13c and 13d clearly show that the self-employment premium has been declining on a trend since the early 1990s.

5.3 Earnings by education

The fall in real labour earnings following the Great Recession was not evenly distributed across education groups. Figure 14a shows the paths of weekly average real labour earnings separately for low and high education workers. Figure 14b shows the education premium.

While the labour earnings of both education groups followed qualitatively similar paths to economy-wide average labour earnings, they did so with somewhat different slopes. Figure 14b shows that the education premium remained roughly stable around 45-47% (perhaps with a very slight decline) in the pre-recession period, then rose sharply to about 55% during the Great Recession. Since then, the education premium showed signs of gradually reverting back to its pre-recession level, although by 2016 it still had some way to go. These changes in the education premium around the time of the Great Recession provide further indication of the fact that the low-education group was the most affected by the recession.

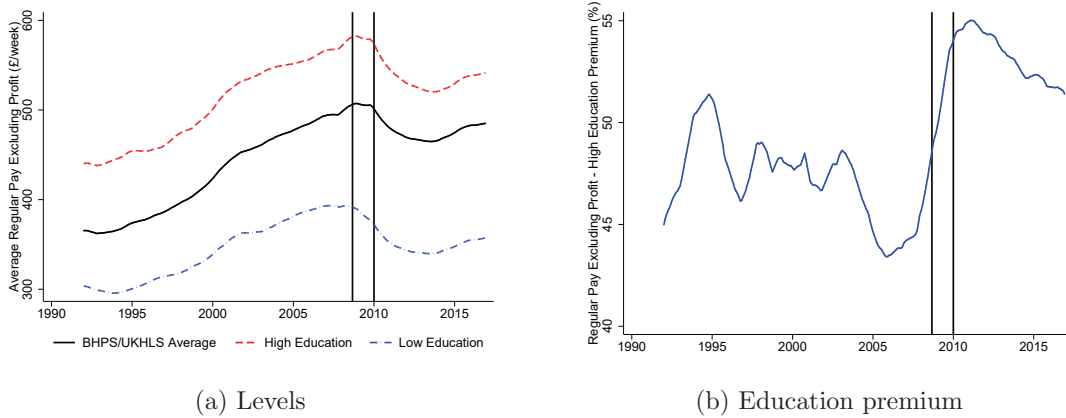


Figure 14: Average real weekly earnings by education group

Figure 15 compares total real earnings of employed and self-employed workers across education groups in terms of levels (Figure 15a), education premium by employment status (Figure 15b), and self-employment premium by education group (Figure 15c). Several facts emerge from Figure 15. First, the education premium is consistently higher amongst employed than amongst self-employed workers, with some degree of convergence between the two employment groups over the sample period (Figure 15b).¹⁶ Second, the self-employment premium is consistently higher for the *low-education* than for the *high-education* group, although again that cross-education-group gap tends to close over time (Figure 15b). More specifically, the self-employment premium for the high-educated is close to zero on

¹⁶Figure 15b may appear somewhat at odds with the aggregate education premium on Figure 14b. The reason is that the latter figure shows a series from which self-employed profits were excluded, whereas they are included in Figure 15b.

average, and on a very slight downward trend over the sample period. By contrast, the self-employment premium for the low-educated is positive and substantial throughout the sample period, dropped sharply in the mid 2000s (from around 20 to around 10%), and started showing signs of rising again in 2014.

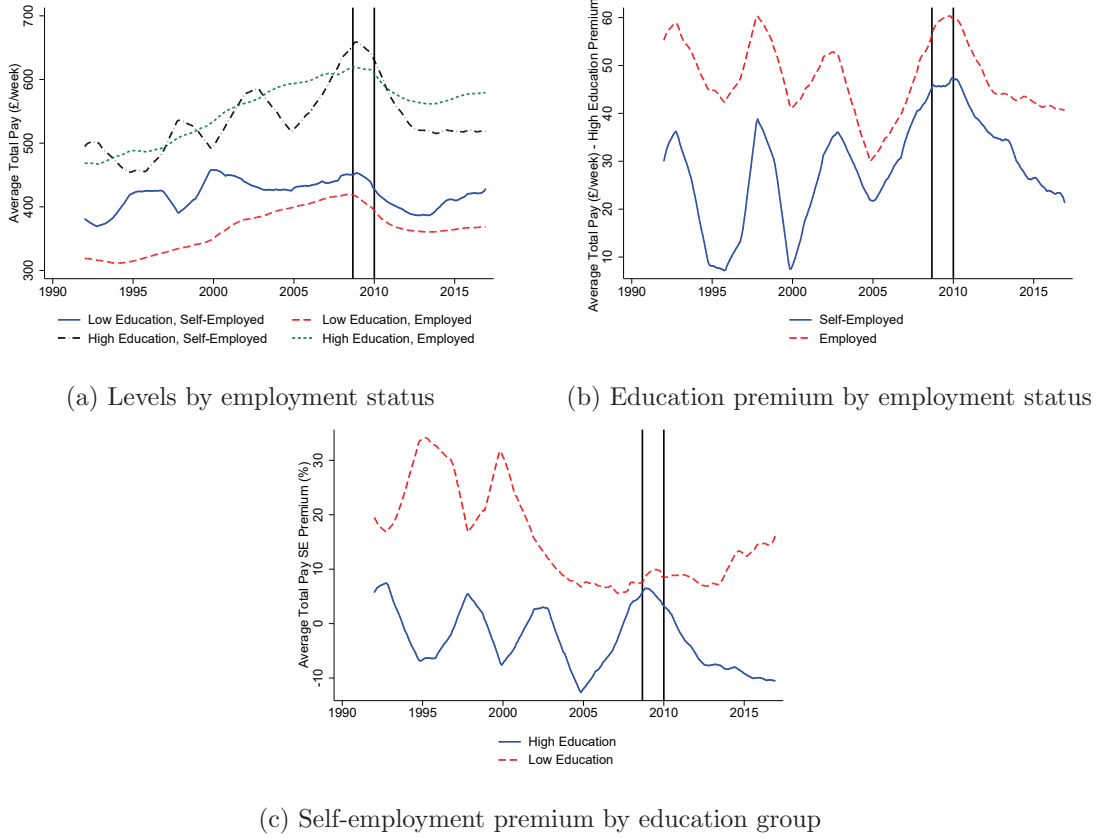


Figure 15: Average real weekly earnings by employment status and education group

6 Job mobility and earnings growth

Using US data, Faberman and Justiniano (2015) and Moscarini and Postel-Vinay (2016, 2017) provided evidence that pressure from labour demand is transmitted to wage growth primarily through job-to-job transitions. Theory suggests that, when labour demand is high, employed workers receive more frequent outside job opportunities. If employed workers tend to quit into better-paying jobs, WW reallocation towards high wage jobs intensifies when labour demand increases, which causes higher average pay growth. Also, the more opportunities workers have to quit, the more aggressive are their employers' pay responses (to try and retain them), which puts further upward pressure on pay. High labour demand also provides unemployed workers with better work opportunities and potentially exerts upward pressure on wages through that channel as well. Empirically, however, Moscarini and Postel-Vinay (2016, 2017) showed that the former channel (WW transitions) is much stronger than the latter.

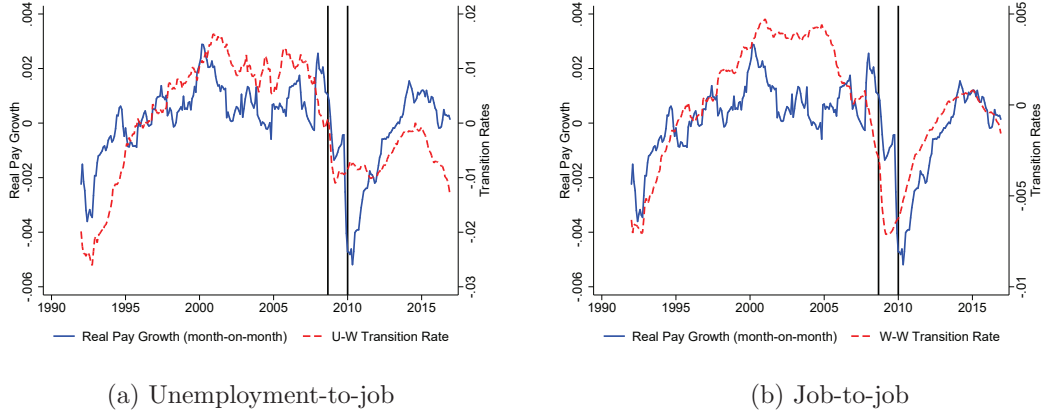


Figure 16: Month-on-month real pay growth and transitions

To assess that hypothesis on UK data, we plot our series of monthly real pay growth together with the UW rate (Figure 16a) and the WW rate (Figure 16b), all series linearly detrended and rescaled for readability. Evidently, average real pay growth is strongly positively correlated with both transition rates. This is confirmed by the first two columns of Table 2, which reports univariate regression coefficients of monthly real pay growth on each transition rate. Column 3 in that table further indicates that, as expected, real pay growth is negatively correlated with the current unemployment rate.

Table 2: Real Earnings Growth (excl. profit) and Labour Market Transitions

	(1)	(2)	(3)	(4)	(5)	(6)
WW transition rate	0.346 (0.0443)			0.325 (0.0796)	0.330 (0.0801)	0.321 (0.0935)
UW transition rate		0.0859 (0.0133)		0.00730 (0.0232)	0.00878 (0.0233)	0.00661 (0.0261)
Unemployment rate			-0.0422 (0.0230)		0.0116 (0.0203)	0.0250 (0.0265)
WU transition rate						-0.322 (0.316)
IW transition rate						0.0688 (0.0761)
WI transition rate						-0.0481 (0.242)
Constant	-0.00521 (0.000830)	-0.00446 (0.000869)	0.00378 (0.00164)	-0.00529 (0.000870)	-0.00625 (0.00188)	-0.00645 (0.00209)
Observations	291	291	297	291	291	291

Standard errors in parentheses

The numbers in Columns 1 and 2 of Table 2 also show that real pay growth is more strongly correlated with the WW rate than with the UW rate, as suggested by the hypothesis outlined above. This is confirmed by Column 4 of Table 2, which show results of a regression in which both the WW and UW rates are included in the right hand side. The WW rate comes out positive, strong and statistically significant, while the coefficient on the UW rate is close to zero and not statistically significant. Adding the unemployment rate and other transition rates as additional controls does not affect that result (Columns 5 and 6 of Table 2).

7 Conclusion

In this paper, we combine information from the BHPS and UKHLS to construct consistent time series of aggregate worker stocks, worker flows and earnings in the UK over the 1992-2016 period for all workers as well as for two separate education groups.

We propose a method to harmonise data between the BHPS and UKHLS, which we validate by checking the consistency of some of our headline time series with equivalent series produced from other sources, notably by the ONS. This allows us to put together what, to our knowledge, is the first aggregate analysis of UK labour market stocks, flows, and earnings based on a “spliced” BHPS-UKHLS data set.

Our main findings are summarised and itemised in the Introduction to this paper. We do not repeat them here. Aside from our substantive results, we hope that this paper will help demonstrate the usefulness of a combined BHPS/UKHLS data set for the study of UK labour markets. While the analysis in this particular paper is almost entirely confined to the aggregate level, it is based on harmonised individual-level employment history data which is ready to be used for micro-level analysis.

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Appendix

A Why we do not use pre-panel employment histories

First the recall bias is likely to be more severe when more time has passed since the employment spell an individual is being asked about. Individuals are asked to recall full job histories at their first interview, which means recalling events that often date back a number of years (or even decades) — typically much longer than the single year individuals are asked to recall at subsequent interviews.

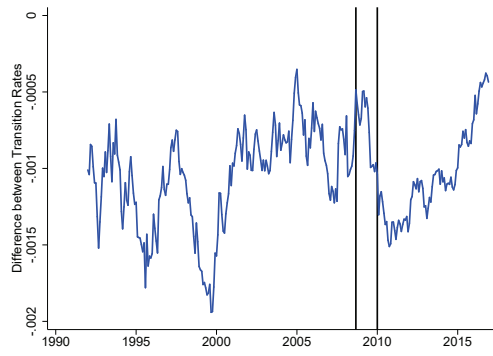
A related problem is that, in many cases, individuals have not reported their full employment history at their first interview. Instead, they only report the start date of their current labour market spell. Because employment spells last much longer on average than non-employment spells, including pre-interview labour market histories in our data would lead us to systematically overestimate the number of employed individuals in the pre-interview period (and underestimate the unemployed and inactive).

Potentially reflecting both of these reasons, we found that including recalled job histories for the period before individuals' first interview resulted in a significant upward bias in the employment rate (and corresponding downward biases in the unemployment and inactivity rates) relative to national statistics.¹⁷

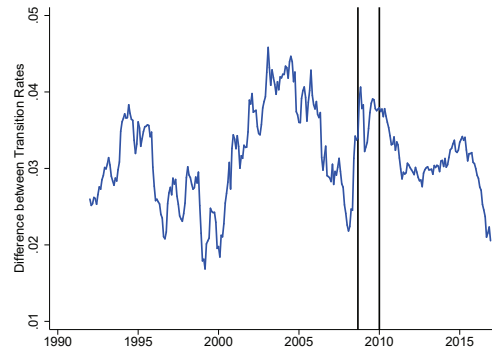
Second, we use individual weights supplied in BHPS and UKHLS to construct our estimates of aggregate stocks and flows to ensure they are representative of the UK population. Unfortunately, no weights are provided for pre-panel years and therefore it is not possible to make pre-panel years representative.

B Differences in Transition Rates Across Education Groups

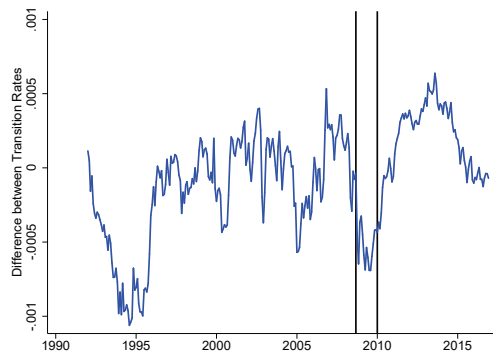
¹⁷Elias (1996) and Paull (2002) both studied recall error in BHPS and came to the conclusion that it can have severe effects over periods longer than three years.



(a) Work to Unemployment



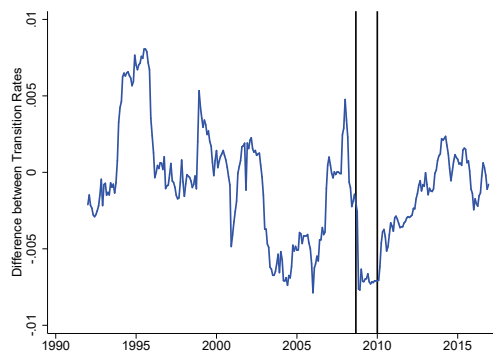
(b) Unemployment to Work



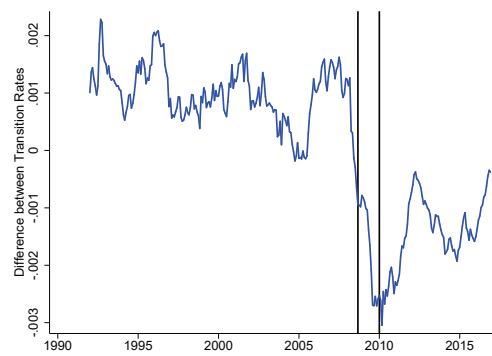
(c) Work to Inactivity



(d) Inactivity to Work

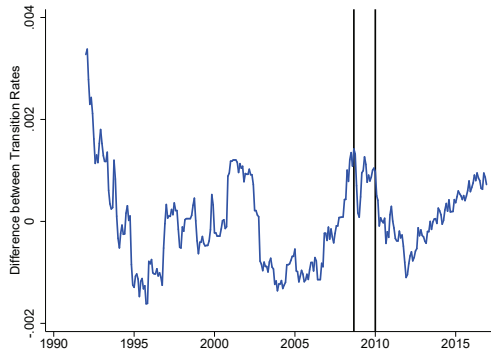


(e) Unemployment to Inactivity

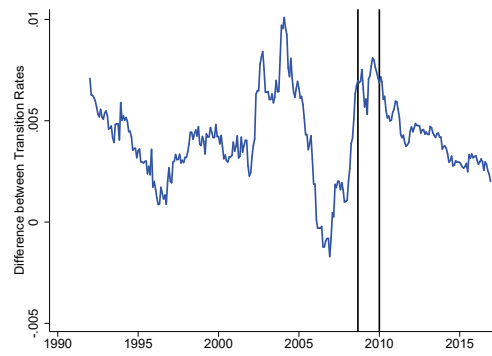


(f) Inactivity to Unemployment

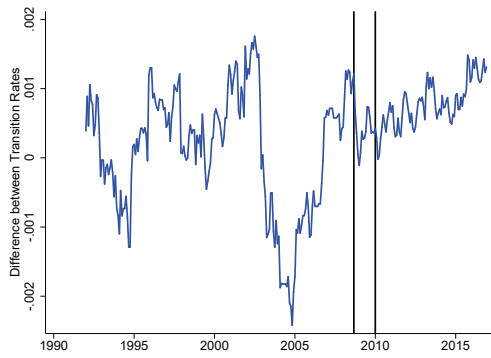
Figure 17: Separation and job finding rates: differences across education groups



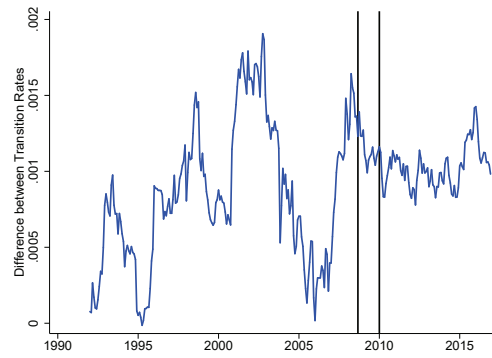
(a) Self-Employment to Unemployment



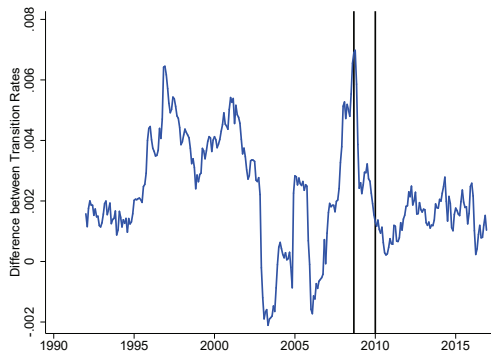
(b) Unemployment to Self-Employment



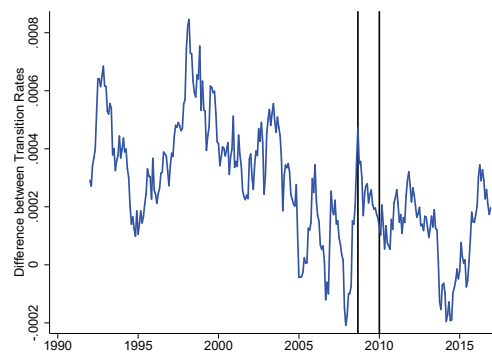
(c) Self-Employment to Inactivity



(d) Inactivity to Self-Employment



(e) Self-Employment to Employment



(f) Employment to Self-Employment

Figure 18: Self-employment transition rates: differences across education groups