

Double trouble: does job loss lead to union dissolution and vice versa?

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Double trouble: does job loss lead to union dissolution and vice versa?

Abstract

A now-substantial literature claims that job loss and union dissolution (the end of a marriage or cohabiting relationship) each increase individuals' risk of the other, highlighting that major negative life events in the labour market and family can spill over across domains. We address three limitations of this research using UK data. First, these associations might arise from unmeasured factors which jointly predispose individuals to the two events. Second, the distinction between job loss (an event) and unemployment (the state it *may* lead to) has been neglected. Third, where the impact of unemployment has been considered, its duration has not. We simultaneously model both processes: does job loss (or being unemployed) lead to union dissolution, and does union dissolution (or being divorced/separated) lead to job loss? To investigate the role of unobserved, time-invariant confounders, we model the individual-specific effects as random variables allowed to correlate across the models for the two outcomes. Upon allowing such cross-process correlations, we find that job loss and union dissolution have modest and non-significant prospective associations with one another. We also find no support for a connection between being divorced/separated and subsequent job loss. Unemployment appears to increase risk of union dissolution; by attending to duration we uncover gender differences in this relationship.

Introduction

Job loss and union dissolution – that is, the end of a marriage or cohabiting relationship – are each associated with a wide range of undesirable consequences (Amato, 2000; Brand, 2015; Leopold, 2018). To experience both is, in Kraft's words, 'likely to be the worst situation one can think of' (2001: 80). This paper examines the links between these major losses. In particular, we test whether established associations between job loss and subsequent union dissolution – and vice versa – can in fact be accounted for by unobserved characteristics of individuals which predispose them to a higher risk of both events. This question has important implications for our understanding of the dynamics of inequality and cumulative disadvantage across the life course.

Extensive bodies of literature now claim that job loss leads to union dissolution, and that union dissolution leads to job loss. A link between job loss (or being unemployed) and subsequent union dissolution has been reported in analyses of the UK (Blekesaune, 2008; Böheim & Ermisch, 2001; Doiron & Mendolia, 2012; Lampard, 1994), Norway (Hansen, 2005; Rege et al., 2007), Finland (Jalovaara, 2003, 2013), Sweden (Eliason, 2012), Denmark (Jensen & Smith, 1990), Germany (Kraft, 2001; Tu et al., 2018), and the US (Attewell, 1999; Banzhaf, 2018; Charles & Stephens, 2004; Killewald, 2016; Starkey, 1996). Conversely, studies also find support for an association between union dissolution and subsequent job loss (Attewell, 1999; Covizzi, 2008; Kalmijn, 2005; Lampard, 1994). While the latter connection has received less attention, these associations persist with the inclusion of controls for a number of relevant observables, such as health status and prior unemployment.

Whether or not such associations are regarded as causal, these findings represent an important glimpse into the ways in which major negative life events in the labour market and family can spill over across domains. Such cascades may result in an accumulation of disadvantage and heightened socioeconomic vulnerability. However, we identify three limitations of the existing literature and seek to contribute by addressing them.

First, these associations might rather be accounted for by unmeasured factors which jointly predispose individuals to experience the two events. Many researchers have voiced this concern but the idea has not been tested explicitly. We advance the evidence on this issue by simultaneously modelling both processes – does job loss lead to union dissolution and does union dissolution lead to job loss? – and by investigating the role of possible unobserved, time-invariant characteristics that may select individuals into both events, and which may therefore have inflated prior estimates of the effect of each on the other. To do this, we model the individual-specific effects as random variables allowed to correlate across the models for the two outcomes.

Second, the distinction between *job loss* and *unemployment* in terms of their consequences for union dissolution has been all-but ignored. The two are distinct phenomena and we argue that their impacts should each be given distinct consideration. From a policy perspective they are different targets and to some extent

pose a choice. Governments might alternately prioritise employment protection policies to guard against job losses, or favour labour market flexibility aimed at job creation to minimise the unemployment rate.

Job loss – defined as involuntary job separation – *need not lead to a spell of unemployment* (Figure 1). Indeed it very often does not. Becker et al. noted evidence that ‘many, if not most, persons find a new job before they quit or are laid off from their old one’ (1977: 1775). In the UK context, 81% of men made redundant – the most frequently reported reason for job loss – ‘had managed to find employment without an intervening spell of ‘non-employment’’ (Arulampalam, 2001: F598). This is not surprising given mandatory periods of redundancy notice in the UK. Individuals under notice, as well as the growing number on temporary contracts, are able to search for new employment and thereby avoid an unemployment spell. In our data, 62.4% of reported job losses are not accompanied by a spell of unemployment.

Figure 1 Panel for a fictitious individual, illustrating the distinction between event (job loss, union dissolution) and state (unemployed, divorced/separated split) independent variables.

*** Figure 1 here ***

The distinction between job loss and unemployment has received little attention across the broad literature on the consequences of these setbacks (Brand, 2015). Research often conflates the two and imagines a homogenous experience whereby job loss leads to a prolonged period of unemployment. Indeed McKee-Ryan and Maitoza’s excellent review begins ‘The detrimental effects of job loss and unemployment are not limited to the unemployed worker but ripple out to affect those closest to him and her’ (2014: 1). Deep recessions aside, many if not most job losers do not become such ‘unemployed worker[s]’. Results from one study which does attend to the difference are suggestive: negative consequences of job loss for partner’s mental wellbeing in Australia were contingent on the job loss leading to a spell of unemployment (Bubonya et al., 2014). By studying both job loss and unemployment we are able to simultaneously address the two sets of studies which have examined either one or the other.

The divorce literature teaches that union dissolution is a stressful process culminating in an event – the separation itself – with heterogeneous consequences depending in part on whether repartnering occurs (Amato, 2000). We therefore also highlight the distinction between union dissolution and being a divorcee, separated, or a former cohabiter (we refer to the latter state as ‘split’). Again, the event may *or may not* lead to the state. Indeed individuals frequently leave one union in order to immediately form another. Accordingly, becoming divorced/separated/split rather than immediately repartnered may disproportionately indicate being a partner who *was left*, likely leading to more negative consequences including a higher likelihood of job loss.

The second contribution of this paper, then, is to distinguish between event and state independent variables. That is, we separately investigate whether job loss – an event – leads to union dissolution, and whether unemployment – a state – leads to union dissolution. With regard to the reverse causal direction, we investigate whether union dissolution leads to job loss, and whether being divorced/separated/split leads to job loss. In distinguishing between events and states, we also follow a core tenet of the stress process paradigm according to which, at the level of individual experience, ‘stress can be seen as arising out of two broad circumstances: the occurrence of discrete events and the presence of relatively continuous problems’ (Pearlin et al., 1981: 338).

The third limitation in the existing literature which we address is that where the impact of unemployment has been considered, its duration has not. This risks missing important heterogeneity: being unemployed for a month is one thing, for two years quite another. Banzhaf (2018) attends to this issue but uses only a linear term for duration. We explore multiple functional forms and find that others produce superior model fit. Our third contribution is thus to explore how risk of each outcome varies by *duration* in each state.

In the following section, we first review the theoretical arguments and empirical evidence for causal associations in each of the two directions. We then argue that there are strong reasons to expect that selection mechanisms play a role in generating the associations described in the existing literature. Methods, results, and discussion follow.

Job loss and unemployment as causes of union dissolution

Income loss and attendant economic strain, deteriorations in psychological wellbeing, family conflict, signals of partner quality, and gendered social norms may each play a role in mediating a causal effect of job loss or unemployment on union dissolution. We outline these mechanisms and, where applicable, how they may apply differently to men and women. For quite intuitive reasons, every mechanism is theoretically expected to apply least strongly in the case of job loss followed by immediate re-employment, and most strongly for long unemployment spells.

Losing a job and becoming unemployed mechanically leads to a reduction in earnings which persists until a new job is found. Considerable reductions in income are attested even for re-employed job losers, because the new job is frequently part-time or of lower quality than the original (Brand, 2015). Increased conflict and dissatisfaction may arise as partners with divergent preferences for household spending contest the allocation of a diminished income (Conger et al., 1990; Dew et al., 2012). Further, the economic strain which often attends income loss mediates a path from job loss to psychological distress (Pearlin et al., 1981).

Job loss may directly lead to psychological distress through the loss of work's psychosocial benefits such as purpose, social networks, status, time structure, and sense of control (Brand, 2015; Krug & Eberl, 2018; Newman, 1988). With re-employment, psychological distress may ease, depending on the quality of the new job (Chandola & Zhang, 2018). As unemployment wears on and coping resources are worn down, these losses may have a stronger effect. Darity and Goldsmith highlight qualitative work describing the experience: initial shock tempered by optimism is followed by 'the second stage, when efforts to obtain work fail, the individual becomes pessimistic and suffers active distress' (1996: 123).

Psychological distress at the individual level is liable to spill over and affect relationships (McKee-Ryan & Maitoza, 2014). Mechanisms attested in the literature include increased alcohol consumption, anger, and violence (Catalano et al., 1993; Kyriacou et al., 1999). Fixed-effects panel models indicate that the mental health of female partners deteriorates following a male partner's job loss (Bubonya et al., 2014; Mendolia, 2014). Job loss and unemployment can turn a relationship into an aversive situation from which individuals are motivated to escape.

The mechanisms described so far do not inherently predict larger effects of male employment setbacks. However they imply a stronger effect if job loss is suffered by the single or majority earner, which in the UK is disproportionately the male in a heterosexual partnership.

Job loss and unemployment may be interpreted as negative signals of partner quality; that is, they add new information concerning a decision made under uncertainty. Individuals who find their partner to be less than they expected may be more likely to leave. One version of this argument focuses on expected future earnings (Becker et al., 1977), while others have argued that the inability to hold down a job signals undesirable characteristics in a partner independently of economic considerations (Charles & Stephens, 2004).

Finally, job loss for a male partner may imperil a relationship due to its violation of the male breadwinner norm (Killewald, 2016). US respondents (male and female) in marriages in which a wife out-earns her husband were more likely to report feeling that the marriage 'might be in trouble' (Bertrand et al., 2015). *Men's* job loss or unemployment may then be especially likely to lead to union dissolution.

Empirical evidence for the association between job loss or unemployment and subsequent union dissolution comes from a range of European countries and the US, as listed above. Each study which attends to this link finds supportive evidence, in a more or less restrictive way. We elaborate briefly on the different approaches taken to the problem of selection into job loss, which have yielded mixed findings. Two studies use fixed-effects models. In Germany, the number of months unemployed over the past year predicted the likelihood of separation, within individuals, for men but not women (Kraft, 2001). Hansen's (2005) fixed-effects analysis suggests no effect of either husband's or wife's unemployment on marital dissolution, though a lack of within-variation reduces the sample size drastically and leaves little power with which to detect an effect.

Several studies have either restricted attention to plausibly exogenous sources of job loss – plant closures, and job displacements more broadly – or compared their impact to that of person-specific modes of job loss such as dismissals. Studies of plant closures in Norway (Rege et al., 2007) and Sweden (Eliason, 2012), and of job displacements in the US (Banzhaf, 2018) all show significant but modest effects when the husband loses his job – 11% and 14% greater risk of divorce respectively in the plant closure studies, over a relatively long follow-up period – and smaller or null effects when the wife loses her job. The two studies comparing different types of job loss each find effects only for those which are person-specific (Charles & Stephens, 2004; Doiron & Mendolia, 2012). These suggest an important role for selection. This is considered in more detail below, following a discussion of the link between union dissolution and subsequent job loss.

Union dissolution as a cause of job loss

Though a number of studies report that union dissolution is consequential for labour market outcomes, far less attention has been given to theorising this link compared with the reverse direction.

Most obviously, union dissolution is highly stressful and this is likely to impact job performance and, if unemployed, the ability to search for and secure a job. Divorce is consistently rated among the most stressful life events (Miller & Rahe, 1997). Under such stress, dismissals are straightforwardly more likely; further, temporary contracts may be less likely to be renewed, and individuals may be more likely to be chosen for redundancy. A deterioration in health and wellbeing caused by the stress of the breakup is a likely mediator. Covizzi (2008) and Kalmijn (2005) include controls for health status *prior* to the union dissolution, their results thus suggesting that the effect of union dissolution on job loss is not however confounded by health.

Other perspectives suggest further mechanisms by which this association might be causal. Under Becker's (1977) model, men suffering a union dissolution lose the opportunity to specialise in market activities, are forced to spend a greater portion of their time on non-market activities (such as caring responsibilities), and become less productive at work as a result, harming their prospects. The sociological literature on 'coupled careers' points to the beneficial effects of a spouse's human capital for labour market success, including likelihood of job loss (Bernasco et al., 1998). With regard to role theory, Kalmijn (2005) observes that the loss of one's marriage may deprive a husband of the breadwinner identity and its attendant motivation to perform well in the labour market.

These perspectives mostly concern the effect *for men*; discussion of the consequences of union dissolution for women places more emphasis on transitions in and out of the labour force rather than in and out of employment (Özcan & Breen, 2012). Nonetheless, for women with a consistent attachment to the labour market, the most prominent mechanism – stress – is no less applicable than to men. It might however be

added that union dissolution tends to result in a greater loss of income for women than men, which might serve to increase motivation and thus reduce the chance of job loss. On the other hand this loss of income may bring further stress and increase risk of job loss.

The acute stresses of the union dissolution event or process itself, such as family conflict and disruption of existing roles and routines, may fade with time. However the state it leads to (if one does not re-partner) may entail chronic stressors such as a reduced level of socioemotional support and a smaller social network. Evidence is mixed as to whether the effects of union dissolution on psychological distress – which might place one at increased risk of job loss – follow a crisis (with recovery) or chronic strain model (Amato, 2000). This makes it unclear whether the acute stresses of having recently experienced the event will yield a stronger association with subsequent job loss, or whether the state and event predictors will show similar associations.

Selection: confounders of the union dissolution-job loss association

Individual differences in characteristics which confer higher risks of experiencing both union dissolution and job loss may confound apparently causal associations between the two events. Among these, important variables such as socioeconomic position and education are routinely included in the models which compose the evidence discussed above for causal associations in each direction. But a further set of difficult-to-observe personal characteristics are also likely to matter.

What sorts of characteristics are likely to predispose individuals to both union dissolution and job loss or unemployment? Many are aspects of personality. Some of the everyday terms that intuitively spring to mind – being unstable, unreliable, difficult to get along with, impulsive, or prone to conflict – correspond closely to the ‘Big Five’ personality traits which are the foundation of most modern research in personality psychology, and which generally exhibit stability across working-age adulthood (Roberts & DelVecchio, 2000).

Accordingly, low conscientiousness and high neuroticism have both consistently been found to be related quite strongly to divorce (Boertien & Mortelmans, 2017; Roberts et al., 2007) and unemployment (Egan et al., 2017; Uysal & Pohlmeier, 2011). Low agreeableness has been linked with divorce (Roberts et al., 2007) and with unemployment duration (Viinikainen & Kokko, 2012). Compliance, straightforwardness, and trust are facets of agreeableness; these would be expected to reduce the risk of job loss. Extraversion, with its implication of meeting new potential partners at a high rate, is robustly associated with divorce in the UK and Germany (Boertien & Mortelmans, 2017); extraversion is also associated with job loss (Wilkins & Wooden, 2013). Some findings even link openness to experience to these outcomes (Boertien & Mortelmans, 2017; Viinikainen & Kokko, 2012; Wilkins & Wooden, 2013). Individuals high on this trait – more curious,

1 willing to experiment, and unpredictable – may be more willing to select into jobs and relationships for which
2 they are in reality not well matched, increasing the likelihood of their dissolution.
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6 There is much to suggest that relatively stable differences predispose individuals to experience both union
7 dissolution and job loss or unemployment. One might also mention other constructs such as cognitive ability
8 or locus of control (Starkey, 1996). Fundamentally, partnerships and jobs are social relations whose
9 continuation depends to a substantial extent on an individual's general ability and willingness to comply with
10 expectations and manage interpersonal relationships.
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20 **Data**

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22 We pool observations from the British Household Panel Survey (BHPS, 1991-2008) and its successor the UK
23 Household Longitudinal Study (UKHLS, 2009-2018), also known as Understanding Society. Both are nationally
24 representative UK household panel surveys. Individuals are interviewed approximately every 12 months, and
25 original sample members are followed if they split from their original household. The BHPS was incorporated
26 into the UKHLS in 2009; as such, some individuals have been surveyed continuously for over 20 years. The
27 two surveys are highly similar in design and content (Fumagalli et al., 2017).
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33 We focus on those in the working-age population likely to have finished their full-time educational careers
34 (ages 21-64). We exclude the widowed and the single (under our definition, those who have never married
35 or cohabitated), as our research questions do not meaningfully apply to them.
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39 Because we estimate systems of simultaneous equations linked at the individual level in which job loss and
40 union dissolution are both outcomes, our sample is also necessarily restricted to individuals we observe at
41 risk of job loss at least once and at risk of union dissolution at least once. For instance, if an individual is never
42 observed in a marital or cohabiting union, then they are never observed at risk of union dissolution and
43 cannot therefore be included.
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52 **Measures**

53 *Job loss*

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56 Our job loss variable measures whether the individual has experienced a job loss over the previous year which
57 they report as due to being made redundant, being dismissed or sacked, or a temporary job ending.
58 Respondents may alternatively indicate that a job ended because they were promoted, left for a better job,
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2 took retirement, for health reasons, left to have a baby, left to look after family, left to look after another
3 person, moved area, started college/university, or 'other reason'; the availability of these alternative
4 categories gives some confidence that we are capturing *involuntary* job loss.
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7 This definition is used for job loss both as dependent and independent variable. Job loss is coded missing for
8 person-years in which the individual has no spell of employment and thus is not at risk of job loss.
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14 *Unemployed (duration)*
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16 Respondents are asked 'which of these best describes your current employment situation?' Among the
17 available choices are various categories of employment, *Unemployed*, and various out-of-the-labour-force
18 categories (including *Long-term sick or disabled*, *On maternity leave*, and *Looking after family or home*).
19 Unemployment is thus self-reported, but individuals have the choice of a range of categories which might
20 better describe their situation if they are not unemployed in the usual sense of being available for work,
21 actively seeking it, and not currently doing any work.
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24 Respondents who report being unemployed are asked for the date when this spell began. We are thus able
25 to calculate unemployment duration, which is top-coded at 10 years.
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28 Where unemployment duration is missing, but we can infer the bounds within which it falls from answers in
29 consecutive waves to the questions on economic status and whether individuals have been continuously
30 unemployed since the last interview, we impute within these known bounds.
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39 *Union dissolution*
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41 Union dissolution is defined as occurring in a given year if an individual at any point changes from being
42 married to either separated or divorced, or from cohabiting to being single. Dissolved cohabitations lasting
43 fewer than three months are not counted. Union dissolution is also indicated if the individual reports
44 consistently being in a union, but the partner changes.
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47 For the BHPS, we draw on the consolidated marital, cohabitation, and fertility histories dataset compiled by
48 Pronzato (2011). For the UKHLS, we draw directly on the marital and cohabitation history questions asked at
49 survey entry, and annual interview questions. These ask about (changes in) both legal and de facto marital
50 status, the latter including the category *Living as [a] couple*. Union dissolution is coded missing for person-
51 years in which an individual is never in a marital or cohabiting relationship.
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60 *Divorced/separated/split (duration)*

Individuals new to the surveys are asked about previous marriages and cohabitations (of three months or more), including their end dates. At each wave, individuals are also asked for the date of any changes in legal marital status. When a cohabitation ends between waves, the date is not asked (except in the UKHLS for individuals who are living with a new partner at the time of interview). In such cases, we impute the median observed duration falling within the same bounds (less than one year), which turns out to be very close to 6 months. We are therefore able to calculate duration divorced/separated/split at the time of interview at each wave. This is also top-coded at 10 years.

Controls

Our models for both union dissolution and job loss include linear and quadratic terms for age, individuals' social class, highest qualification, and a term for the combination of period, survey, and sample. Social class of the individual's current or (if not employed) most recent job follows a five-category version of the NS-SEC: large employers and higher managerial or professional; lower managerial or professional; intermediate, small employers and own-account workers, and lower supervisory or technical; semi-routine; routine and manual or never worked. Highest qualification is split into five categories: degree; higher education below degree; A-level or equivalent; GCSE or equivalent; and below GCSE. Our period & survey/sample variable distinguishes 1991-1999 BHPS observations, 2000-2008 BHPS observations, the 2010-2018 observations of BHPS sample members who continue to be surveyed as part of the UKHLS, and the 2009-2018 main group of UKHLS observations. In the union dissolution model, we also include an indicator for whether the individual has any children aged under 16 in the household.

Analytical approach

Our analysis proceeds in three stages, each of which is applied to the two outcomes: union dissolution and job loss. For each outcome, the three stages are carried out for each of the two types of independent variable of interest: events (job loss, union dissolution), and states (being unemployed, being divorced/separated/split) and their duration. All analyses are stratified by gender.

First, (illustrating with the event predictors) we estimate separate random-effects logistic panel regressions testing the associations between (a) job loss between $t-2$ and $t-1$ and a union dissolution occurring between $t-1$ and t (versus remaining married or cohabiting), and (b) union dissolution between $t-2$ and $t-1$ and a job loss occurring between $t-1$ and t (versus remaining employed or voluntarily leaving the job). We refer to these as model 1 in each case. Second, the same models are run with the addition of controls for observed characteristics which might confound the associations of interest (model 2).

In the third stage, we jointly estimate the two outcomes as a system of simultaneous equations. This is model 3. The difference between the second and third models is that a nonzero ‘cross-process’ correlation is allowed between the individual-level random effects for the two outcomes (Lillard et al., 1995; Steele, 2003; Steele et al., 2013). This allows for the fact that unobservable characteristics which make individuals more likely to experience job losses may also make them more likely to experience union dissolutions; this would be reflected in a positive correlation. Constraining the correlation to zero, as in the separately-estimated models, imposes the restriction that there is no joint selection into union dissolution and job loss on these unobservable characteristics. In the presence of such unobservables, this assumption would lead to overestimation of the effects of job loss on union dissolution and vice versa (and of the effects of their equivalent states). Further detail is given below.

Our events-as-predictors models thus take the following form (note that some terms are superscripted with the outcome of the model in which they appear – *UD* for union dissolution and *JL* for job loss):

$$\text{logit}(\Pr(UD_{it})) = \alpha_0 + \alpha_1 \text{Job loss}_{it-1} + \alpha_k \mathbf{x}_{it-1k}^{UD} + u_i^{UD} \#(1')$$

$$\text{logit}(\Pr(JL_{it})) = \beta_0 + \beta_1 \text{Union dissolution}_{it-1} + \beta_k \mathbf{x}_{it-1k}^{JL} + u_i^{JL} \#(2')$$

i and *t* index individuals and time points respectively. The α and β terms are coefficients. *Job loss* and *Union dissolution* are binary indicators of the occurrence of said event in the past 12 months (i.e. the interval from *t*-2 to *t*-1). The \mathbf{x}_k terms are equation-specific vectors of time-varying controls, with vectors of coefficients α_k and β_k . The addition of these controls distinguishes model 2 from model 1. The u_i terms represent the individual-level random effects in each equation.

Model 3 is distinguished from model 2 by joint estimation of the two outcomes as a system of simultaneous equations, in which a nonzero correlation between u_i^{UD} and u_i^{JL} is allowed. This relaxes the standard random effects assumption that job loss is uncorrelated with the unobserved determinants of union dissolution, and vice versa. To the extent that correlations between the regressors and the random effects in model 2 are generated by unobserved time-invariant characteristics of individuals, the random effects in model 3 will now capture these influences. After accounting for the individual effects and their correlation, estimates of α_1 and β_1 are based on within-individual variation and represent the effects of job loss and union dissolution respectively, adjusted for time-invariant confounders of this association (Steele et al., 2013).

Our states-as-predictors models are as follows:

$$\text{logit}(\Pr(UD_{it})) = \gamma_0 + \gamma_1 \text{Unemployed}_{it-1} + \gamma_2 \text{Unemployed} \times \text{Duration}_{it-1} + \gamma_k \mathbf{x}_{it-1k}^{UD} + v_i^{UD} \#(3')$$

$$\text{logit}(\Pr(JL_{it})) = \delta_0 + \delta_1 \text{Divorced}_{it-1} + \delta_2 \text{Divorced} \times \text{Duration}_{it-1} + \delta_k \mathbf{x}_{it-1k}^{JL} + v_i^{JL} \#(4')$$

Unemployed is a dichotomous indicator of being unemployed, while *Unemployed* × *Duration* represents the best-fitting form of its interaction with unemployment duration (set to zero for the employed). Analogously,

Divorced and *DivorcedXDuration* are terms for being divorced/separated/split and the best-fitting form of its interaction with duration in that state. The functional form of the *Duration* term in each case was chosen through a comparison of the AIC values of versions of the final model fitted with different functional forms of *Duration* (see Supplementary Table S1). Except for the removal of the event terms and addition of the state and duration terms, these equations are directly analogous to (1') and (2'). The claim to control for unobserved confounding in the states-as-predictors model 3 relies on the further assumptions that the stable unobserved individual-level determinants of job loss are essentially the same as those of unemployment and its duration; and that the stable unobserved individual-level determinants of union dissolution are essentially the same as those of the divorced/separated/split state and its duration.

Prior to estimating (3') and (4') in full, we also report results from models which exclude the duration interaction terms. This yields estimates of the association of unemployment with subsequent union dissolution, and being divorced/separated/split with subsequent job loss, *without* considering heterogeneity by duration. However our focus is on the results that *do* attend to duration.

Note that the samples are necessarily slightly different for the state and event models. For instance, a person-year observation for an individual who is continually unemployed between $t-2$ and $t-1$ cannot be included in the (event) model in which union dissolution between $t-1$ and t is a function of job loss between $t-2$ and $t-1$ – the person was not at risk of job loss in that period. Since we also model two outcomes, and do this all separately for men and women, our samples altogether comprise eight distinct sets of observations. Descriptive statistics for each set of observations are shown in Supplementary Table S2. The state and event samples for each combination of gender and outcome do not differ substantively in terms of our demographic covariates.

The set of *individuals* in the sample is held constant across the two outcomes, for each gender and each type of independent variable. For these four sets of individuals, Supplementary Table S3 shows the joint distribution of union dissolutions and job losses. The clear majority of individuals experience neither of the events of interest during the period we observe them. However they do contribute information to the estimation of the correlations between the random intercepts: an individual who consistently does not experience either of these events may have a lower than average random intercept for both outcomes, implying a positive correlation. Finally, Supplementary Table S4 shows the number of cases upon which our estimates are ultimately based: occurrences of (for example) a union dissolution followed by a job loss over the following year.

Results

Events-as-predictors models

1 We first discuss results from our events-as-predictors models, presented in Table 1. Does job loss lead to
2 union dissolution? Our results are highly similar for men and women. In the baseline models (1), the odds
3 ratios are large and significant (1.40 (95% CI 1.13-1.75) for men, 1.38 (1.09-1.74) for women). These attenuate
4 slightly with the addition of the controls in model 2 (1.30 (1.04-1.62); 1.28 (1.01-1.61)). After accounting for
5 correlation in the random intercepts across the two models, these associations attenuate further, becoming
6 non-significant in model 3 (1.13 (0.90-1.43); 1.19 (0.93-1.52)). These correlations are modest – 0.18 for men
7 and 0.11 for women – but taking them into account brings an odds ratio of 1 within the 95% confidence
8 interval. Unobservables that jointly select individuals into union dissolutions and job losses appear to play a
9 confounding role.

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20 *** Table 1 here ***

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25 The findings are highly similar for the other causal direction, the association between union dissolution and
26 subsequent job loss. Again, for both men and women, the coefficient for union dissolution is significant in
27 model 2 (1.31 (1.03-1.65) for men; 1.34 (1.06-1.69) for women), but allowing for a correlation between the
28 random intercepts attenuates the estimates – to a greater extent in this direction – and they no longer reach
29 the conventional threshold of statistical significance (1.08 (0.83-1.40); 1.18 (0.91-1.54)).

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36 *** Table 2 here ***

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41 The attenuation between models 2 and 3 is also substantively important. Table 2 shows predicted
42 probabilities of each outcome with covariates set to selected representative values. In each case, for both
43 models 2 and 3, we show predictive margins for the same individual experiencing the relevant event in the
44 previous year and not doing so, the difference being the marginal effect for individuals with that set of
45 characteristics. In many cases the attenuation is substantively large, and particularly for the effect of union
46 dissolution on job loss: for example, for men with qualifications below GCSE level in low social class
47 occupations, the marginal effect from model 2 is 1.2 percentage points, corresponding to a 26% increased
48 risk of job loss; in model 3, the figure is 0.3 percentage points and a 7% increased risk.

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57 *States-as-predictors models*

Next, do being unemployed and being divorced/separated/split increase the risk of these same outcomes? We first briefly present results for state models without a duration interaction term. Including the controls and cross-process correlation, being unemployed (relative to being employed) has an odds ratio of 1.67 (1.34-2.08) for men and 1.85 (1.48-2.31) for women. However, being divorced/separated/split (relative to cohabiting or being married) has a non-significant and relatively weak association with subsequent job loss: odds ratios of 1.17 (0.98-1.39) for men and 1.10 (0.93-1.29) for women. These results however ignore heterogeneity according to how long individuals have been in these states; we focus on models which explore this variation.

The choice of the functional form of the duration terms – *Duration* in equations (3') and (4') above – is discussed in the Online Supplement. In all cases, the models with no duration term had clearly worse fit than most alternatives in terms of AIC (see Supplementary Table S1). This confirms that the associations of the state predictors with their respective outcomes depend on duration in the state.

*** Table 3 here ***

Table 3 shows the results of the state models. We first discuss the union dissolution outcome. Unemployment and its interaction terms with duration remain jointly significant across the three models for both men and women, indicating that these associations are not accounted for by either the observed covariates or any unobservables that jointly select individuals into union dissolutions and job losses. With regard to these unobservables, the cross-process correlations are modest (0.16 for men, 0.11 for women) but statistically significant. Their practical significance is best evaluated by comparing models 2 and 3 in each case, which we do below.

Figure 2 Predicted probability of union dissolution between $t-1$ and t for men and women unemployed at $t-1$ (by duration of unemployment), and for men and women employed at $t-1$. Estimated from models 1-3 in Table 3.

*** Figure 2 here ***

Note: estimated for (a) men or (b) women aged 40, of intermediate (or equivalent) social class, with A-level (or equivalent) qualifications and child(ren) aged under 16, from the UKHLS.

Figure 3 Predicted probability (with 95% confidence interval) of union dissolution between $t-1$ and t for men and women unemployed at $t-1$ (by duration of unemployment), and for men and women employed at $t-1$. Estimated from model 3 in Table 3.

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2 *** Figure 3 here ***
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4 Note: see Figure 2.
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8 The substantive importance of unemployment and the nature of its dependence on duration are illustrated
9 in Figure 2, which plots predicted probabilities of union dissolution from each of models 1-3 for men and
10 women of age 40, with children, and with education and social class in the middle of their respective ranges.
11 The equivalent prediction for an employed individual is also shown.
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15 Most striking is the contrast between the convex function in the plot for men and the concave function for
16 women. For men the risk of union dissolution appears to be especially heightened – in fact doubled –
17 immediately following entry into unemployment, falling sharply in the first year before again rising. Our main
18 results – from model 3 – are shown with a 95% confidence interval in Figure 3. These bounds indicate that
19 the risk of union dissolution over the following year for men is in fact significantly higher only among those
20 who have very recently entered unemployment – up to around three months’ duration – and those who have
21 been unemployed for a very long period – around five years and beyond.
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24 For women by contrast, the risk of union dissolution in the very early stages of unemployment is no greater
25 than for employed women; however it increases sharply up to around two years of unemployment before
26 reaching a plateau. There may be a decline as unemployment duration goes beyond five years, but in this
27 part of the range the confidence interval becomes very wide. For both men and women, the close overlap
28 between the lines for models 2 and 3 confirms that allowing the cross-process correlations does not
29 substantially alter these results.
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32 Is such a specific pattern for men – so striking a contrast with the pattern for women – an arbitrary product
33 of the functional form chosen for duration of unemployment? Figures 2 and 3 are replicated (as
34 Supplementary Figures S1 and S2) using the second-best-fitting functional forms. The results are highly
35 similar, suggesting that they are not contingent on a particular choice from among the set of similarly well-
36 fitting functional forms.
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39 We move now to the results for job loss as a function of duration in the state divorced/separated/split – that
40 is, time since the end of a marital or cohabiting union, conditional on not having repartnered. These are also
41 shown in Table 3. In this case the state indicator and its interaction with duration are jointly significant in
42 model 2 ($p < 0.001$ for men, $p = 0.013$ for women) but not in model 3 ($p = 0.112$; $p = 0.254$), suggesting that
43 part of the added risk of job loss for the divorced/separated/split relative to the married or cohabiting owes
44 confounding by unobserved traits which select individuals into both job loss and union dissolution. This is
45 reflected in the predicted probabilities shown in Figure 4: there is an appreciable divergence between the
46 lines for model 2 and model 3.
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Figure 4 Predicted probability of job loss between $t-1$ and t for men and women divorced/separated/split at $t-1$ (by duration divorced/separated/split), and for men and women married/cohabiting at $t-1$. Estimated from models 1-3 in Table 3.

*** Figure 4 here ***

Note: estimates for (a) men or (b) women aged 40, of intermediate (or equivalent) social class, with A-level (or equivalent) qualifications, from the UKHLS. Predictions at ≤ 1 month not shown because the natural log transformation in this range produces extremely wide confidence intervals.

Figure 5 Predicted probability (with 95% confidence interval) of job loss between $t-1$ and t for men and women divorced/separated/split at $t-1$ (by duration divorced/separated/split), and for men and women married/cohabiting at $t-1$. Estimated from model 2 in Table 3.

*** Figure 5 here ***

Note: see Figure 4.

Figure 6 Predicted probability (with 95% confidence interval) of job loss between $t-1$ and t for men and women divorced/separated/split at $t-1$ (by duration divorced/separated/split), and for men and women married/cohabiting at $t-1$. Estimated from model 3 in Table 3.

*** Figure 6 here ***

Note: see Figure 4.

In this case the functional form is similar for men and women: the risk of job loss appears marginally higher following a union dissolution for those who do not immediately repartner, and is soon indistinguishable from that of the married or cohabiting. Judging only from the point estimates, for women the risk is no greater than for a married or cohabiting woman after five years, while for men the predicted probabilities do not fully converge. Figure 5 shows the model 2 results with a confidence interval. This shows that even before adjusting for selection on unobservables, any significant increase in risk of job loss is limited to those who have recently experienced a union dissolution but not repartnered. The predicted probabilities from model 3, shown with a confidence interval in Figure 6, are only modestly smaller, but at *no* point across the range of duration significantly differ from the prediction for a married or cohabiting individual.

Finally we briefly discuss the control variables (see Supplementary Tables S5 and S6). Risk of union dissolution and of job loss are each known to be socially stratified and this is reflected in our results, though the nature and pattern of these social gradients varies by outcome and by gender. We find that children are associated with a lower risk of dissolution.

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Discussion

The aim of this paper was to bring together two important literatures linking the family and the labour market, and in doing so broaden and improve the evidence on how setbacks in one domain can spill over and cause problems in the other. We noted previous findings that job loss and unemployment are associated with union dissolution, and that union dissolution and being divorced are associated with subsequent job loss. We make three main contributions.

First, by estimating panel models for both outcomes simultaneously we are able to adjust for time-invariant unobservables that may select individuals into both events, and which may therefore have inflated prior estimates of the effect of each on the other. This yields our main finding: *job loss and union dissolution per se have modest and non-significant prospective associations with one another* after accounting for this cross-process correlation.

Our finding that job loss does not lead to union dissolution is at odds with prior research. Studies of apparently exogenous job losses have tended to report substantial effects on the likelihood of divorce (Banzhaf, 2018; Eliason, 2012; Rege et al., 2007). The contrast with our findings may be due to variation in context – none of these focuses on the UK. Another possible explanation is that they consider union dissolutions within a longer follow-up period. We allow one year for a job loss to lead to a union dissolution (we do not depend for our measure on the finalisation of a legal divorce), and may therefore only capture short-term impacts. On the other hand, a long follow-up window is likely to add noise: with observational data it is difficult to confidently attribute divorce to job loss occurring (for instance) eight years earlier, and to reject the possibility of confounding. A related possibility is that some endogeneity may remain in designs identifying a job loss effect based on (between-individuals variation in) workplace closures. Individuals may selectively join organisations likely to fail (indeed they must contribute to some degree to this failure), and this can only be partially adjusted for by observable controls. Further, where exogenous job loss is identified through workers’ reports that the reason was, for instance, ‘slack work or business conditions’ or ‘employer sold business’ (Banzhaf, 2018), it is certainly plausible that workers were singled out for job loss on the basis of individual characteristics.

Our results are closer to those studies which find effects only for person-specific job losses such as firings (Charles & Stephens, 2004; Doiron & Mendolia, 2012). However they nonetheless differ. Consider an individual with some characteristics which make them relatively undesirable as both an employee and a partner, and who loses their job and subsequently is left by their romantic partner. These studies argue for a causal effect through a signalling mechanism: had the job loss not occurred, the individual’s undesirability as a partner would remain concealed and there would be no union dissolution. To the contrary, our results suggest that had the job loss not occurred, the likelihood of a union dissolution is close to the same, because

the undesirable characteristics increase the risk of union dissolution regardless of the job loss. Both mechanisms may play a role to varying degrees, but our findings are consistent with the latter.

Second, we make the observation that *job loss* per se and *unemployment* are distinct phenomena and their impacts should each be given distinct consideration. Involuntary job loss very often does not lead to a spell of unemployment. Analogously, we separately investigate the impacts of union dissolution and the state of being divorced (or separated, or split from a cohabiting union). Union dissolution need not lead to a spell without a partner – indeed an individual may end one union in order to join another.

These distinctions have been largely overlooked, but our results indicate their importance. Indeed, we find that it is the spell of unemployment rather than the job loss itself that increases the risk of union dissolution. *Unemployment is significantly associated with subsequent union dissolution whereas job loss is not.* This echoes previous research linking unemployment with union dissolution. On the other hand, as in our event analyses, once time-invariant unobservables are taken into account we find no support for a connection between being divorced/separated/split and subsequent job loss, in contrast with the small emerging literature making this claim.

The preceding analysis is however limited in that it homogenises the groups in each of these states. Third then, going beyond the considerable body of prior research on the links between unemployment and union dissolution, we explore heterogeneity in the association between our state predictors and our outcomes, according to *how long individuals have been in the relevant state*. In doing so we uncover striking gender differences in the dependence of union dissolution risk on duration unemployed. For men, unemployment increases the risk of union dissolution over the following year, but this is only evident among those in the first three months or so of an unemployment spell, and for those whose unemployment has lasted beyond approximately five years. The corresponding pattern for the women in our sample is strikingly different. For women, the very early stages of unemployment are not characterised by any difference in risk compared with the employed; however risk of union dissolution then sharply rises with duration in that state.

Why do we see this contrast, and why does the dependence on unemployment duration take each particular form for men and women? In general, variability of the association across the range of duration will be due to some combination of the changing effect of unemployment and changing selectivity of the at-risk group. The norm that a male partner be employed may be relevant to explaining the gender difference (Killewald, 2016). On this account, male unemployment may have a large and swift destabilising effect on gender-traditional unions in particular – manifesting in high risk for those recently unemployed – while for less gender-traditional unions, the stresses and strains of ongoing unemployment lead to a steadily increasing risk of dissolution. This accords with Sherman's (2009) ethnographic finding that increased marital discord upon male unemployment was primarily observed among the 'rigid' couples which adhered to strict gender roles rather than finding a new basis for positive masculine identity such as being a good father. A second

potential explanation for the pattern in the early part of the duration range is that – without invoking heterogeneity between couples – the period immediately following entry into unemployment constitutes a crisis period which is particularly destabilising. This may be particularly the case when the man in a heterosexual relationship becomes unemployed, since he is more likely to be the higher or sole earner.

Previous research contains mixed findings about the impact of women's unemployment. Our findings suggest that short spells – which are the majority – have a small impact, while those unemployed for longer periods are substantially more likely to experience a union dissolution than the employed. This is consistent with a model under which the stresses and strains of unemployment accumulate over time, but couples rarely view women's entry into unemployment as a norm violation, as may be the case for men.

The overarching pattern of our results is that allowing for cross-process correlations changes the conclusions we draw about whether and how home life and work life spill over and affect one another. One might conclude that time-invariant unobservables are highly important in this context, or one might disagree and argue that the associations in question were weak to begin with and hovered on the brink of statistical significance: accounting for unobservables in this way merely happened to nudge them to the other side of an arbitrary line. Indeed it is worth emphasising that our model 3 estimates are clearly in no case significantly different from our model 2 estimates. Our interpretation treads a middle ground and notes some other relevant considerations. We have already observed that the differences between the marginal effects from event models 2 and 3 are modest but important: our outcomes are rare and stressful, and so even a small change adds valuable information.

First, the correlations between the random intercepts for each outcome were in the range 0.11-0.18. Though significant, these values are neither immediately striking nor straightforward to interpret. They represent the correlation between individuals' predispositions to experience job losses and union dissolutions. For comparison, the analogous correlation in the BHPS between random intercepts for being unemployed and for a measure of psychological distress is estimated at 0.27 (Steele et al., 2013: 708). This is an association where joint selection on unobservables is widely recognised as a potential threat to a causal estimate (Kröger et al., 2015; Krug & Eberl, 2018). A value of 0.27 in a context where unobserved confounders are demonstrably important may be taken to imply that even correlations of 0.11-0.18 hold substantive interest. Second, we note that the attenuations between our various models 2 and 3 are markedly larger when considering the effect of union dissolution or being divorced/separated/split on job loss, a hypothesised causal relationship with a less firm theoretical and empirical basis. It is plausible that effectively constraining the cross-process correlation to zero in prior work on this question has somewhat inflated estimates.

Some limitations to this study should be borne in mind. Although our independent variables are lagged by one year, we cannot completely rule out the possibility of anticipation effects and thus a form of reverse causality – for instance if couples separate because a job loss appears likely. Our measure of social class at

least captures variation in economic security to some degree. We do not address partner characteristics, but call for future research to examine the role they may play in moderating these associations. We do not distinguish between divorces, marital separations, and dissolutions of cohabiting relationships. These may relate to job loss in different ways. Marriage may signal a stronger commitment, though recent qualitative evidence from the UK does also indicate that ‘personal commitment is similar in cohabiting and marital relationships ... Public displays of commitment are increasingly occurring in other ways [than marriage], such as childbearing and joint mortgages’ (Berrington et al., 2015: 327). We control for a range of observed factors associated with the decision whether to cohabit or marry, and only count cohabitations lasting at least three months. Sample size prohibits productive analyses disaggregating marriages from cohabitations. A related limitation is that like almost all studies in this area we do not know who initiates the union dissolution in each case. *Being left* may have a greater impact on labour market outcomes.

We also do not distinguish between the three types of job endings we include within our measure of job loss. Previous work using the BHPS has found heterogeneous associations with divorce according to type of job loss (Doiron & Mendolia, 2012). However, this heterogeneity is attributed to the greater selectivity of (person-specific) dismissals compared with redundancies and temporary job endings, which we have aimed to control for.

Another concern is time-varying confounding. Our approach controls for time-invariant unobserved heterogeneity, but factors could conceivably arise which for instance cause both a job loss and then a union dissolution, with the former not causally related to the latter. First, for confounding of our estimates of interest to occur, the time-varying factor would need to not cause both events to occur close together temporally, but would need to cause one and then the other. A sudden, severe exogenous crisis might be expected to disrupt both domains simultaneously rather than in this specific temporal order. Second, such factors as one might imagine – a spell of poor health or some kind of substance abuse or gambling problem, for instance – may be flare-ups of long-standing conditions and thus partly picked up through our adjustment for the time-invariant unobservables. Third, given our mainly null findings, relevant time-varying factors would have to be suppressors rather than confounders in order to nullify our conclusions. We see no clear candidates for such time-varying suppressor variables.

Our results lend further support to the widely-reported finding that unemployment, particularly among men, destabilises relationships. In addition however, this analysis reaches a conclusion at odds with much previous work examining the associations between job loss specifically and union dissolution. It suggests that stable, unmeasured characteristics of individuals may be important – though by no means the most important – determinants of major negative life events. What these characteristics *are* and how their influence might be modified are important questions for future research.

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For Peer Review

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Table 1 Random-effects logistic regressions. Events-as-predictors models.

Outcome	Union dissolution						Job loss					
	Men			Women			Men			Women		
	1	2	3	1	2	3	1	2	3	1	2	3
Job loss	1.40**	1.30*	1.13	1.38**	1.28*	1.19						
Union dissolution							1.38**	1.31*	1.08	1.39**	1.34*	1.18
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Cross-process correlation allowed	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Standard deviation of u_i	1.96	1.77	1.78	2.12	1.92	1.94	1.26	1.20	1.20	1.18	1.15	1.15
Intraclass correlation	0.54	0.49	0.49	0.58	0.53	0.53	0.32	0.31	0.31	0.30	0.29	0.29
N (observations)	79906	79906	79906	82600	82600	82600	72279	72279	72279	75290	75290	75290
N (individuals)	13999	13999	13999	15109	15109	15109	13999	13999	13999	15109	15109	15109
Mean obs. per individual	5.71	5.71	5.71	5.47	5.47	5.47	5.16	5.16	5.16	4.98	4.98	4.98
AIC		39798	39790		39798	39796		39798	39790		39798	39796
Likelihood-ratio test <i>p</i> value (3 vs 2)			0.001			0.057			0.001			0.057
Correlation between random intercepts			0.18***			0.11*			0.18***			0.11*
95% confidence interval			0.07-0.28			0.00-0.22			0.07-0.28			0.00-0.22

Note: all covariates from *t*-1. For each gender, models 3 for each outcome are estimated simultaneously. Coefficients of control variables shown in Supplementary Table S5.

* *p* < .05, ** *p* < .01, *** *p* < .001.

Table 2 Predicted probabilities of job loss with and without prior union dissolution and vice versa.

	Education & social class	Children	Model	Job loss			Union dissolution		
				(a)	(b)	(b)-(a)	(a)	(b)	(b)-(a)
				No UD	UD	Marginal	No JL	JL	Marginal
				at t-1	at t-1	effect	at t-1	at t-1	effect
Men	High	Yes	2	0.026	0.034	0.007	0.013	0.017	0.003
		Yes	3	0.027	0.029	0.002	0.014	0.015	0.002
	Mid	Yes	2	0.025	0.032	0.007	0.020	0.024	0.005
		Yes	3	0.026	0.027	0.002	0.020	0.022	0.002
	Mid	No	2	0.025	0.032	0.007	0.039	0.048	0.009
		No	3	0.026	0.027	0.002	0.040	0.044	0.004
	Low	Yes	2	0.048	0.061	0.012	0.017	0.021	0.004
		Yes	3	0.048	0.052	0.003	0.017	0.019	0.002
Women	High	Yes	2	0.024	0.031	0.007	0.026	0.032	0.006
		Yes	3	0.024	0.028	0.004	0.027	0.031	0.004
	Mid	Yes	2	0.025	0.032	0.008	0.039	0.047	0.008
		Yes	3	0.025	0.029	0.004	0.040	0.045	0.005
	Mid	No	2	0.025	0.032	0.008	0.043	0.051	0.009
		No	3	0.025	0.029	0.004	0.043	0.049	0.006
	Low	Yes	2	0.028	0.037	0.009	0.040	0.049	0.008
		Yes	3	0.029	0.033	0.005	0.041	0.047	0.006

Note: all estimates for individuals aged 40 and from the UKHLS. UD: union dissolution. JL: job loss. 'High' social class and education: higher managerial / professional with a degree. 'Mid': intermediate / small employers and own-account workers / lower supervisory or technical, with A-level or equivalent qualifications. 'Low': routine and manual or never worked, with qualifications below GCSE level.

Table 3 Random-effects logistic regressions. States-as-predictors models.

Outcome	Union dissolution						Job loss					
	Men			Women			Men			Women		
	1	2	3	1	2	3	1	2	3	1	2	3
Unemployed	3.32***	2.97***	2.62***	1.09	1.07	1.02						
Unemployed X duration (months)	1.04**	1.04**	1.04**	0.97	0.98	0.98						
Unemployed X duration (months ^1/2)	0.69**	0.71*	0.73*	1.44*	1.37	1.38						
Divorced / separated / split							1.91***	1.64**	1.38	1.77**	1.52*	1.35
Divorced... X duration (ln(months))							0.90	0.94	0.95	0.88*	0.93	0.93
Joint significance test <i>p</i> value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.112	0.003	0.013	0.254
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Cross-process correlation allowed	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Standard deviation of u_i	1.99	1.80	1.80	2.15	1.95	1.98	1.26	1.20	1.20	1.12	1.10	1.10
Intraclass correlation	0.55	0.50	0.50	0.58	0.54	0.54	0.32	0.30	0.30	0.28	0.27	0.27
N (observations)	94176	94176	94176	88993	88993	88993	93474	93474	93474	98521	98521	98521
N (individuals)	16855	16855	16855	17479	17479	17479	16855	16855	16855	17479	17479	17479
Mean obs. per individual	5.59	5.59	5.59	5.09	5.09	5.09	5.55	5.55	5.55	5.64	5.64	5.64
AIC		50768	50755		48713	48709		50768	50755		48713	48709
Likelihood-ratio test <i>p</i> value (3 vs 2)			<0.001			0.016			<0.001			0.016
Correlation between random intercepts			0.16***			0.11*			0.16***			0.11*
95% confidence interval			0.08-0.24			0.02-0.20			0.08-0.24			0.02-0.20

Note: all covariates from *t*-1. For each gender, models 3 for each outcome are estimated simultaneously. Coefficients of control variables shown in Supplementary Table S6. Joint significance test: a Wald test of the null hypothesis that the coefficients reported are jointly (simultaneously) equal to zero.

* *p* < .05, ** *p* < .01, *** *p* < .001.

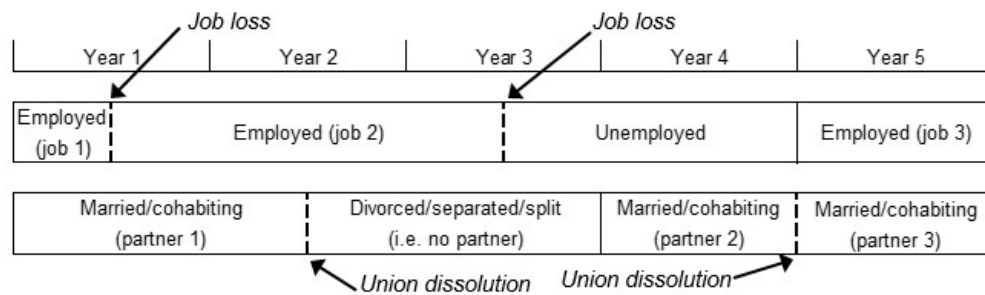


Figure 1

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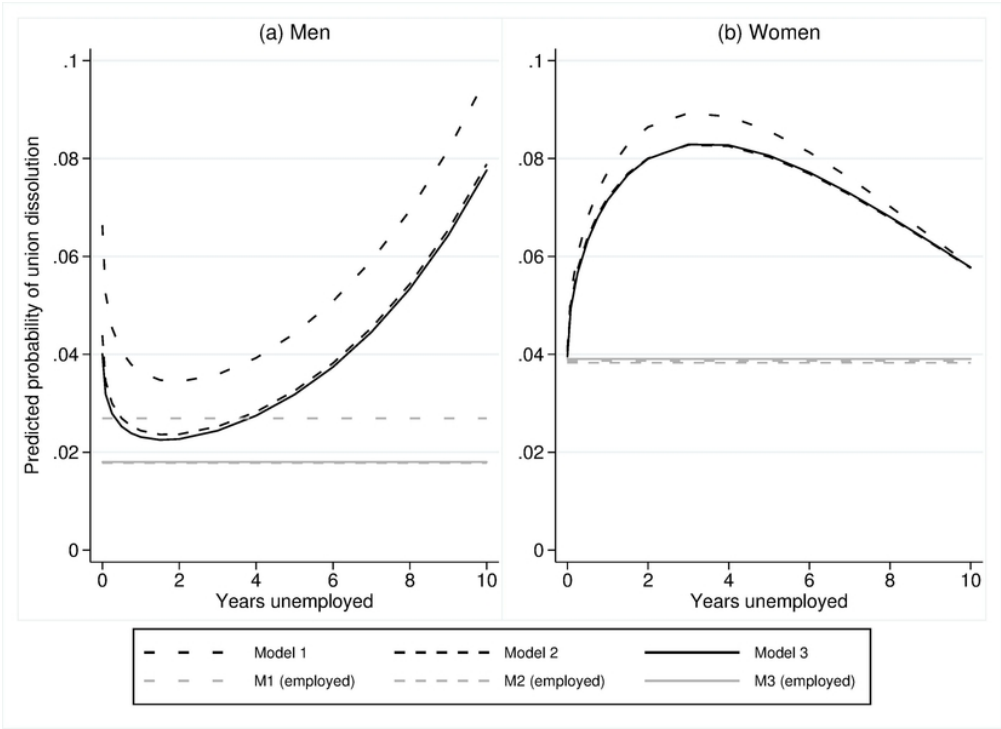


Figure 2

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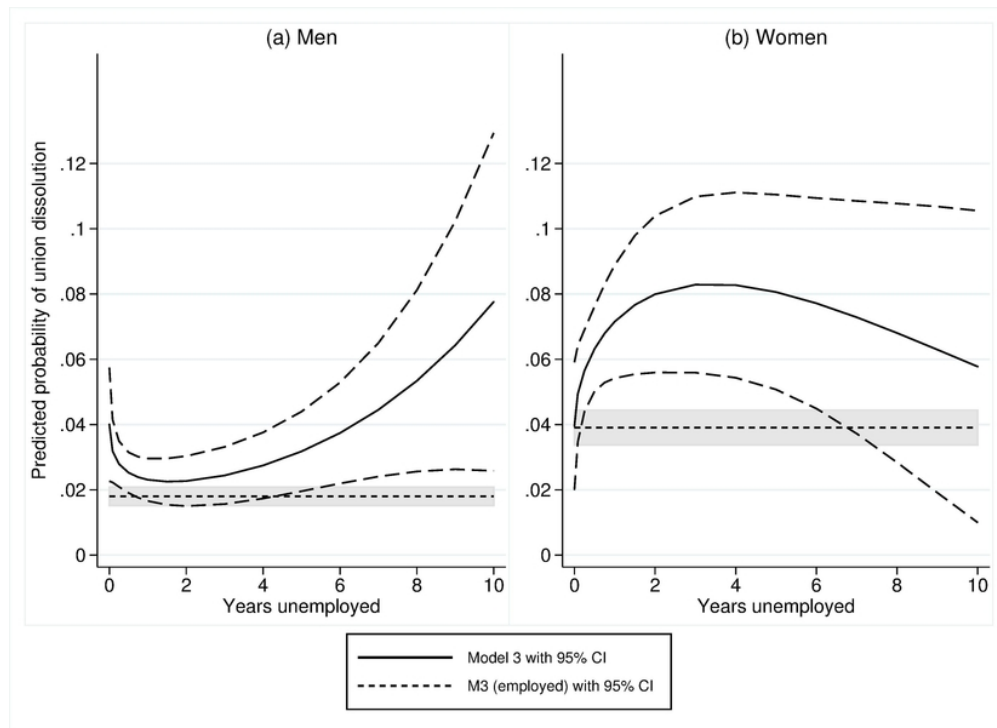


Figure 3

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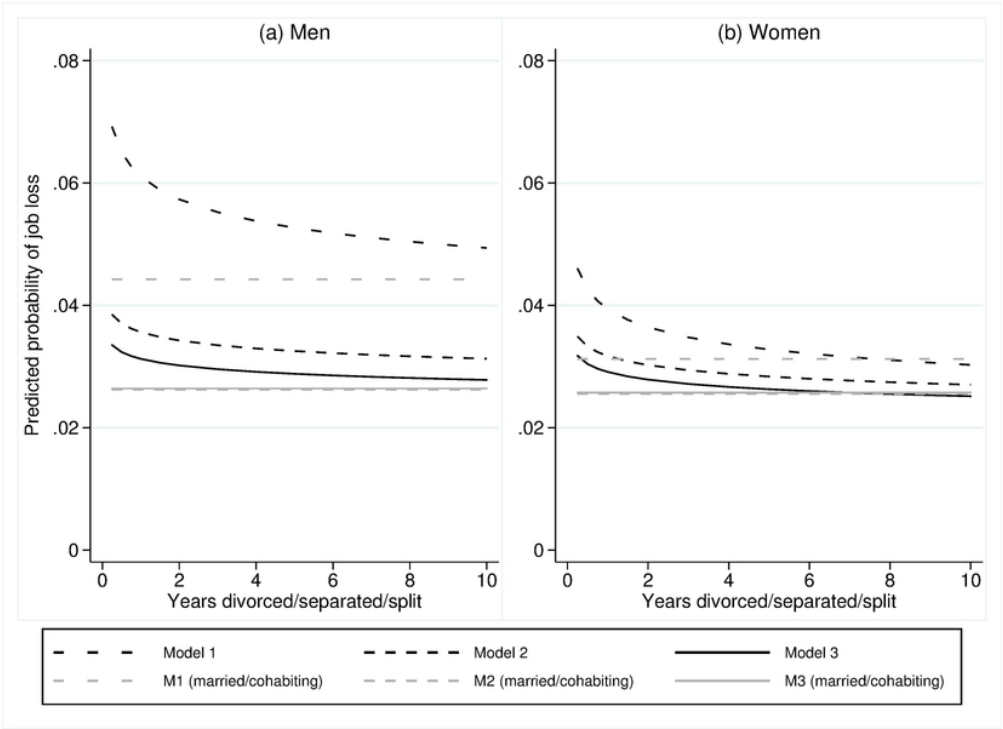


Figure 4

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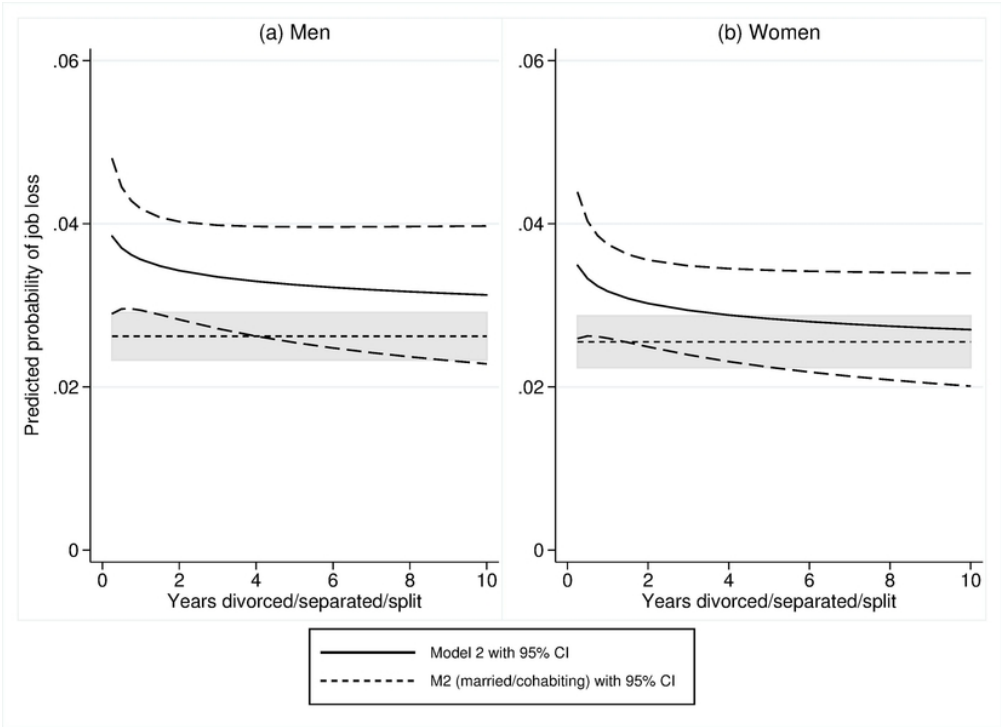


Figure 5

139x101mm (150 x 150 DPI)

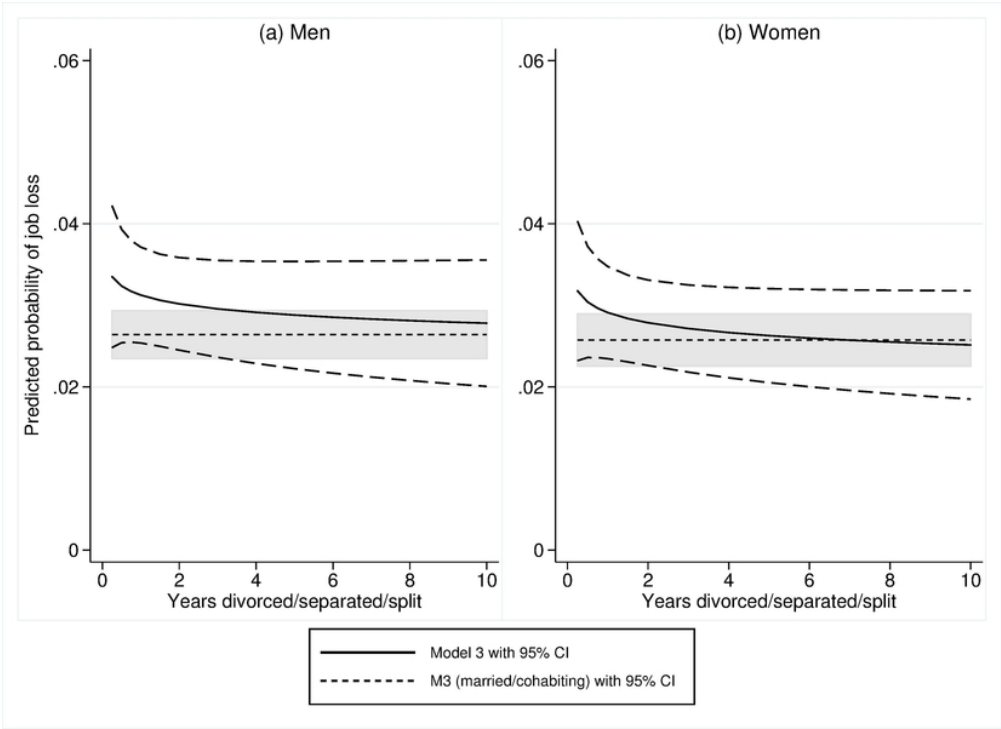


Figure 6

139x101mm (150 x 150 DPI)

Online Supplement for *Double Trouble: does job loss lead to union dissolution and vice versa?*

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Table S6 Random-effects logistic regressions. States-as-predictors models.

Figure S1 Predicted probability of union dissolution between $t-1$ and t by duration unemployed at $t-1$, using second-best-fitting functional form of duration unemployed (linear term and a natural log term).

Figure S2 Model 3 from Figure S1, with 95% confidence interval.

Figure S3 Predicted probability of job loss between $t-1$ and t by duration divorced/separated/split at $t-1$, using second-best-fitting functional form of duration divorced/separated/split (square root).

Figure S4 Model 2 from Figure S3, with 95% confidence interval.

Figure S5 Model 3 from Figure S3, with 95% confidence interval.

Table S1 Model fits (AIC values for model 3) for alternative functional forms of state duration interacted with state indicator. With discussion.

State	Unemployed		Divorced/separated/split	
<i>Functional form of duration in interaction term(s)</i>	Men	Women	Men	Women
No interaction (state indicator only)	50814.67	48786.12	50814.67	48786.12
Linear	50774.61	48736.77	50798.88	48760.52
Squared	50772.02	48737.32	50798.97	48760.83
Square root	50776.94	48735.65	50798.88	48760.24
Natural log	50777.74	48734.06	50798.82	48759.85
Five categories	50819.81	48790.29	50820.17	48792.41
Two categories	50818.64	48786.86	50818.02	48789.19
Linear term and squared term	50772.26	48737.25	50800.88	48762.19
Linear term and square root term	50771.13	48735.16	50800.87	48761.94
Linear term and natural log term	50771.43	48735.23	50800.79	48761.73

Note: these are AIC values for the version of the state model 3 produced by including each of the alternative transformations/versions of the *Duration* terms in equations (3') and (4'), for the outcomes union dissolution and job loss respectively. *Duration* in equation (3') represents duration unemployed; *Duration* in equation (4') represents duration divorced/separated/split. Different forms of *Duration* (unemployed) were tested while holding *Duration* (divorced/separated/split) constant (at 0) in the other simultaneously-estimated model, and vice versa. *Five categories* uses <6 months, 6-12 months, 12-24 months, 24-60 months, and ≥60 months. *Two categories* uses <12 months and ≥12 months.

Discussion: for duration divorced/separated/split, in the case of both men and women the best-fitting model (by a small margin) included an interaction between an indicator for being in the state and the natural log of the duration. With regard to unemployment duration, interactions with both a linear term and a square-root term together fit best for men. For women, the model with an interaction with the natural log of duration had the lowest AIC, but the improvement over the model chosen for men was negligible (48735.16-48734.06 = 1.10) (Burnham & Anderson, 2004), so for simplicity of presentation the same form was selected for men and women.

Figures 2 and 3 from the manuscript are replicated (as Supplementary Figures S1 and S2) using a linear term and a natural log term for duration unemployed. This is the second-best-fitting model for men, and again negligibly different from the best-fitting model for women (48735.23-48734.06=1.17).

Reference:

Burnham, K. P., & Anderson, D. R. (2004). Multimodel Inference: Understanding AIC and BIC in Model Selection. *Sociological Methods & Research*, 33(2), 261–304.

Table S2 Descriptive statistics, by sample.

Outcome Main predictor	Men				Women			
	Union dissolution		Job loss		Union dissolution		Job loss	
	State	Event	State	Event	State	Event	State	Event
<i>Outcomes</i>								
Union dissolution (%)	2.3	2.3			3.0	2.9		
Job loss (%)			4.4	4.1			3.1	3.0
<i>Predictors (t-1)</i>								
Unemployed (%)	3.8				2.8			
Duration unemployed (months)								
25th percentile	3.5				3.3			
50th percentile	6.6				3.3			
75th percentile	19.4				11.2			
Job loss (since t-2) (%)		4.7				3.3		
Divorced/separated/split (%)			4.7				7.2	
Duration divorced etc. (months)								
25th percentile			5.9				9.5	
50th percentile			24.0				29.2	
75th percentile			56.5				67.2	
Union dissolution (since t-2) (%)				2.3				2.9
Age (mean)	42.9	43.1	42.9	43.3	42.2	42.1	41.8	42.2
Social class (NS-SEC5) (%)								
Higher managerial / professional	17.8	18.1	17.9	18.3	8.4	8.1	8.2	8.3
Lower managerial / professional	25.2	25.6	25.5	25.7	32.6	32.2	32.3	32.3
Intermediate etc.	34.5	34.5	34.4	34.2	31.4	31.6	31.1	31.3
Semi-routine	10.5	10.2	10.4	10.2	19.3	19.4	19.7	19.5
Routine and manual	11.9	11.7	11.9	11.6	8.3	8.6	8.7	8.6
Highest qualification (%)								
Degree	24.8	24.5	25.0	25.2	26.0	25.3	25.9	26.0
Higher education below degree	10.3	10.2	10.4	10.3	13.6	13.3	13.5	13.4
A-level or equivalent	24.1	24.6	24.3	24.4	18.6	18.7	18.9	18.7
GCSE or equivalent	22.2	22.5	22.2	22.2	24.3	24.7	24.5	24.6
Below GCSE	18.6	18.3	18.1	17.8	17.5	18.0	17.2	17.3
Own child aged <16 in household (%)	50.7	50.1	48.3	50.4	45.7	47.4	47.9	48.6
Period & survey/sample (%)								
BHPS, 1991-1999	20.5	22.9	20.6	20.1	19.2	21.2	19.3	18.8
BHPS, 2000-2008	25.3	28.8	26.2	29.1	24.5	27.0	24.7	27.2
BHPS, 2010-2018	11.2	12.1	11.4	10.8	11.6	12.6	12.1	11.2
UKHLS, 2009-2018	43.0	36.2	41.8	40.0	44.8	39.2	43.9	42.9
N (observations)	94176	79906	93474	72279	88993	82600	98521	75290
N (individuals)	16855	13999	16855	13999	17479	15109	17479	15109
Mean observations per individual	5.59	5.71	5.55	5.16	5.09	5.47	5.64	4.98

Note: descriptive statistics given at the observation-level.

Table S3 Number of union dissolutions and job losses observed per individual, by sample.

		Union dissolutions					Union dissolutions				
		0	1	2	3	≥4	0	1	2	3	≥4
		Men: states-as-predictors sample					Women: states-as-predictors sample				
Job losses	0	12,187	1,041	167	34	14	12,756	1,512	312	76	18
	1	2,028	290	61	18	7	1,715	318	103	17	6
	2	511	97	27	4	1	343	65	31	12	3
	3	167	32	15	1	3	101	23	9	4	1
	≥4	88	38	13	7	3	32	16	4	1	1
		Men: events-as-predictors sample					Women: events-as-predictors sample				
Job losses	0	9,766	885	166	33	14	10,792	1,304	295	75	18
	1	1,818	265	57	17	7	1,572	290	103	17	8
	2	484	93	27	4	1	335	64	30	12	3
	3	164	31	15	1	3	101	23	9	4	1
	≥4	88	37	12	7	3	32	15	4	1	1

Table S4 Number of observations with positive predictor and outcome.

Predictor	Outcome (between t-1 and t)	Men		Women	
		N	%	N	%
<i>State (t-1)</i>					
Divorced/separated/split	Job loss	274/4412	6.21	272/7117	3.82
Unemployed	Union dissolution	154/3575	4.31	156/2472	6.31
<i>Event (between t-2 and t-1)</i>					
Union dissolution	Job loss	97/1672	5.80	91/2172	4.19
Job loss	Union dissolution	124/3748	3.31	110/2747	4.00

Note: denominator is number of observations for which the predictor =1, numerator is the subset of those for which the outcome also =1.

Table S5 Random-effects logistic regressions. Events-as-predictors models.

Outcome	Union dissolution						Job loss					
	Men			Women			Men			Women		
	1	2	3	1	2	3	1	2	3	1	2	3
Job loss	1.40**	1.30*	1.13	1.38**	1.28*	1.19						
Union dissolution							1.38**	1.31*	1.08	1.39**	1.34*	1.18
Age		0.90***	0.90***		0.90***	0.91***		0.90***	0.90***		0.95**	0.95**
Age squared		1.00	1.00		1.00*	1.00		1.00***	1.00***		1.00*	1.00*
Social class (NS-SEC5)												
Lower managerial / professional		1.25*	1.25*		1.10	1.10		1.12	1.12		0.95	0.95
Intermediate etc.		1.38**	1.38**		1.11	1.11		0.86*	0.85*		0.96	0.97
Semi-routine		1.37*	1.35*		1.20	1.19		1.45***	1.44***		0.90	0.90
Routine and manual		1.15	1.14		1.37*	1.37*		1.52***	1.52***		1.07	1.07
Highest qualification												
Higher education below degree		1.23	1.23		1.27*	1.27*		1.01	1.01		0.85	0.85
A-level or equivalent		1.11	1.11		1.47***	1.48***		1.12	1.12		1.08	1.08
GCSE or equivalent		1.24*	1.25*		1.55***	1.55***		1.14	1.15		1.08	1.08
Below GCSE		1.14	1.14		1.26	1.26		1.29**	1.29**		1.14	1.13
Own child aged <16 in household		0.44***	0.43***		0.89	0.88						
Period & survey/sample												
BHPS, 2000-2008		1.07	1.07		1.30***	1.31***		0.75***	0.76***		0.64***	0.64***
BHPS, 2010-2018		1.69***	1.70***		1.84***	1.87***		0.53***	0.54***		0.46***	0.47***
UKHLS, 2009-2018		1.19	1.18		1.57***	1.56***		0.55***	0.55***		0.49***	0.49***
Standard deviation of u_i	1.96	1.77	1.78	2.12	1.92	1.94	1.26	1.20	1.20	1.18	1.15	1.15
Intraclass correlation	0.54	0.49	0.49	0.58	0.53	0.53	0.32	0.31	0.31	0.30	0.29	0.29
N (observations)	79906	79906	79906	82600	82600	82600	72279	72279	72279	75290	75290	75290
N (individuals)	13999	13999	13999	15109	15109	15109	13999	13999	13999	15109	15109	15109
Mean obs. per individual	5.71	5.71	5.71	5.47	5.47	5.47	5.16	5.16	5.16	4.98	4.98	4.98
AIC		39798	39790		39798	39796		39798	39790		39798	39796
Likelihood-ratio test <i>p</i> value (3 vs 2)			0.001			0.057			0.001			0.057
Correlation between random intercepts			0.18***			0.11*			0.18***			0.11*

Note: all covariates from *t*-1. For each sex, models 3 for each outcome are estimated simultaneously.

Table S6 Random-effects logistic regressions. States-as-predictors models.

Outcome	Union dissolution						Job loss					
	Men			Women			Men			Women		
	1	2	3	1	2	3	1	2	3	1	2	3
Unemployed	3.32***	2.97***	2.62***	1.09	1.07	1.02						
Unemployed X duration (months)	1.04**	1.04**	1.04**	0.97	0.98	0.98						
Unemployed X duration (months ^1/2)	0.69**	0.71*	0.73*	1.44*	1.37	1.38						
Divorced / separated / split							1.91***	1.64**	1.38	1.77**	1.52*	1.35
Divorced... X duration (ln(months))							0.90	0.94	0.95	0.88*	0.93	0.93
Age		0.91***	0.90***		0.91***	0.91***		0.89***	0.89***		0.93***	0.93***
Age squared		1.00*	1.00*		1.00	1.00		1.00***	1.00***		1.00***	1.00***
Social class (NS-SEC5)												
Lower managerial / professional		1.22*	1.22*		1.05	1.05		1.08	1.08		0.91	0.91
Intermediate etc.		1.31**	1.31**		1.10	1.09		0.83**	0.83**		0.98	0.98
Semi-routine		1.26	1.24		1.21	1.20		1.41***	1.40***		0.90	0.90
Routine and manual		1.09	1.07		1.26	1.26		1.56***	1.56***		1.09	1.09
Highest qualification												
Higher education below degree		1.29*	1.29*		1.43***	1.44***		1.05	1.05		0.83*	0.83*
A-level or equivalent		1.17	1.17		1.47***	1.48***		1.15*	1.16*		1.06	1.06
GCSE or equivalent		1.33**	1.34**		1.50***	1.51***		1.19*	1.19*		1.05	1.05
Below GCSE		1.15	1.16		1.23	1.23		1.31***	1.31***		1.14	1.13
Own child aged <16 in household		0.44***	0.43***		0.91	0.91						
Period & survey/sample												
BHPS, 2000-2008		1.07	1.07		1.25**	1.26**		0.72***	0.73***		0.63***	0.63***
BHPS, 2010-2018		1.58***	1.59***		1.63***	1.66***		0.52***	0.52***		0.48***	0.49***
UKHLS, 2009-2018		1.02	1.01		1.34***	1.33***		0.53***	0.53***		0.50***	0.50***
Standard deviation of u_i	1.99	1.80	1.80	2.15	1.95	1.98	1.26	1.20	1.20	1.12	1.10	1.10
Intraclass correlation	0.55	0.50	0.50	0.58	0.54	0.54	0.32	0.30	0.30	0.28	0.27	0.27
N (observations)	94176	94176	94176	88993	88993	88993	93474	93474	93474	98521	98521	98521
N (individuals)	16855	16855	16855	17479	17479	17479	16855	16855	16855	17479	17479	17479
Mean obs. per individual	5.59	5.59	5.59	5.09	5.09	5.09	5.55	5.55	5.55	5.64	5.64	5.64
AIC		50768	50755		48713	48709		50768	50755		48713	48709
Likelihood-ratio test <i>p</i> value (3 vs 2)			< 0.001			0.016			< 0.001			0.016
Correlation between random intercepts			0.16***			0.11*			0.16***			0.11*

Note: all covariates from *t*-1. For each sex, models 3 for each outcome are estimated simultaneously.

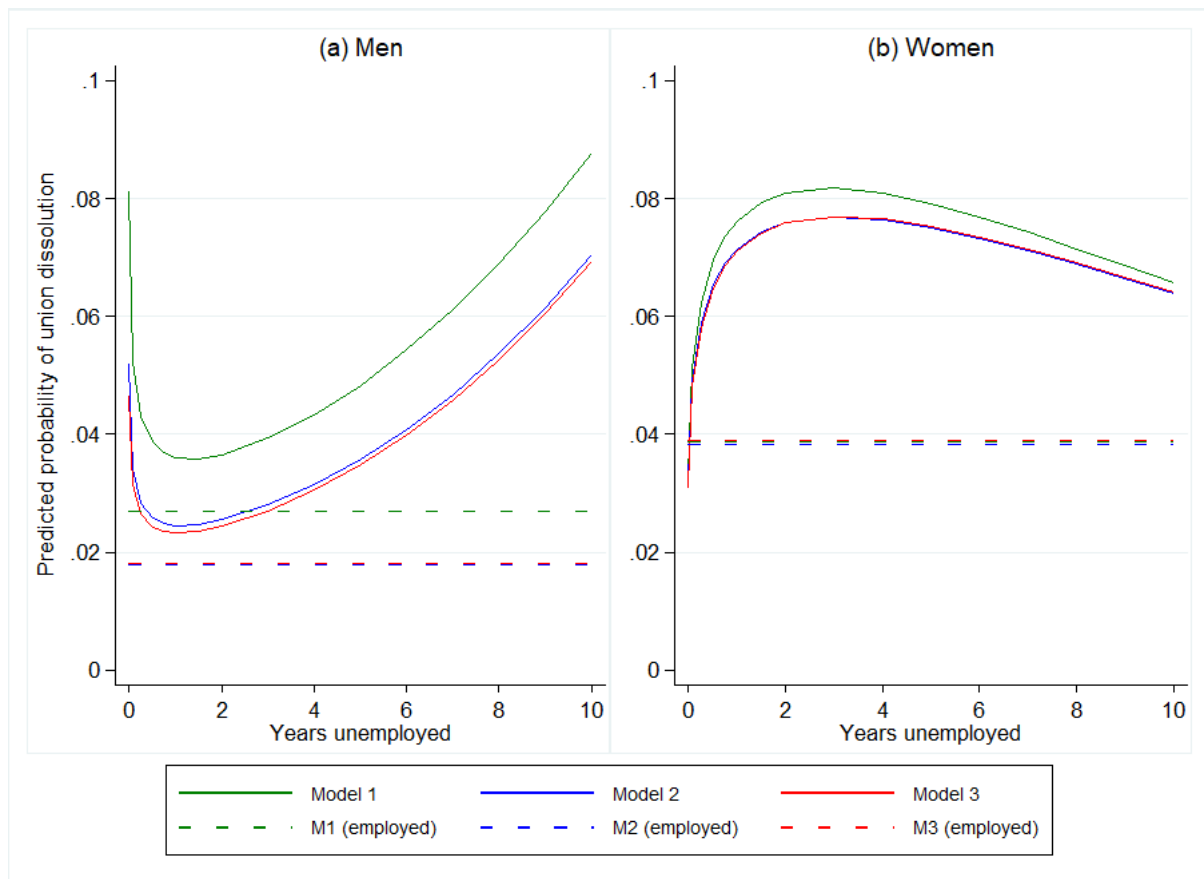


Figure S1 Predicted probability of union dissolution between $t-1$ and t by duration unemployed at $t-1$, using second-best-fitting functional form of duration unemployed (linear term and a natural log term).

Note: estimates for (a) men or (b) women aged 40, of intermediate (or equivalent) social class, with A-level (or equivalent) qualifications and child(ren) aged under 16, from the UKHLS. Compare Figure 2, which uses the *first-best-fitting* functional form of duration unemployed (linear term and square root term).

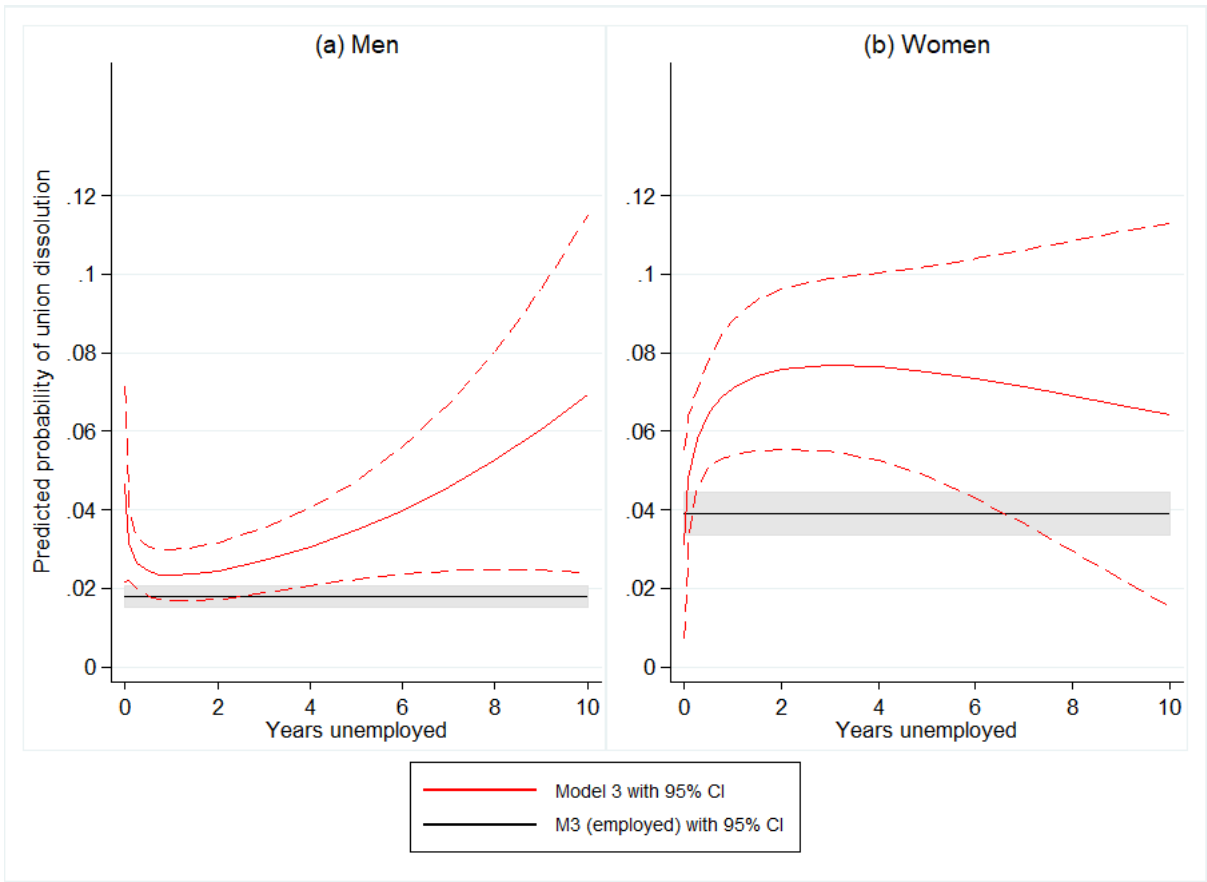


Figure S2 Model 3 from Figure S1, with 95% confidence interval.

Note: see Figure S1. Compare Figure 3.

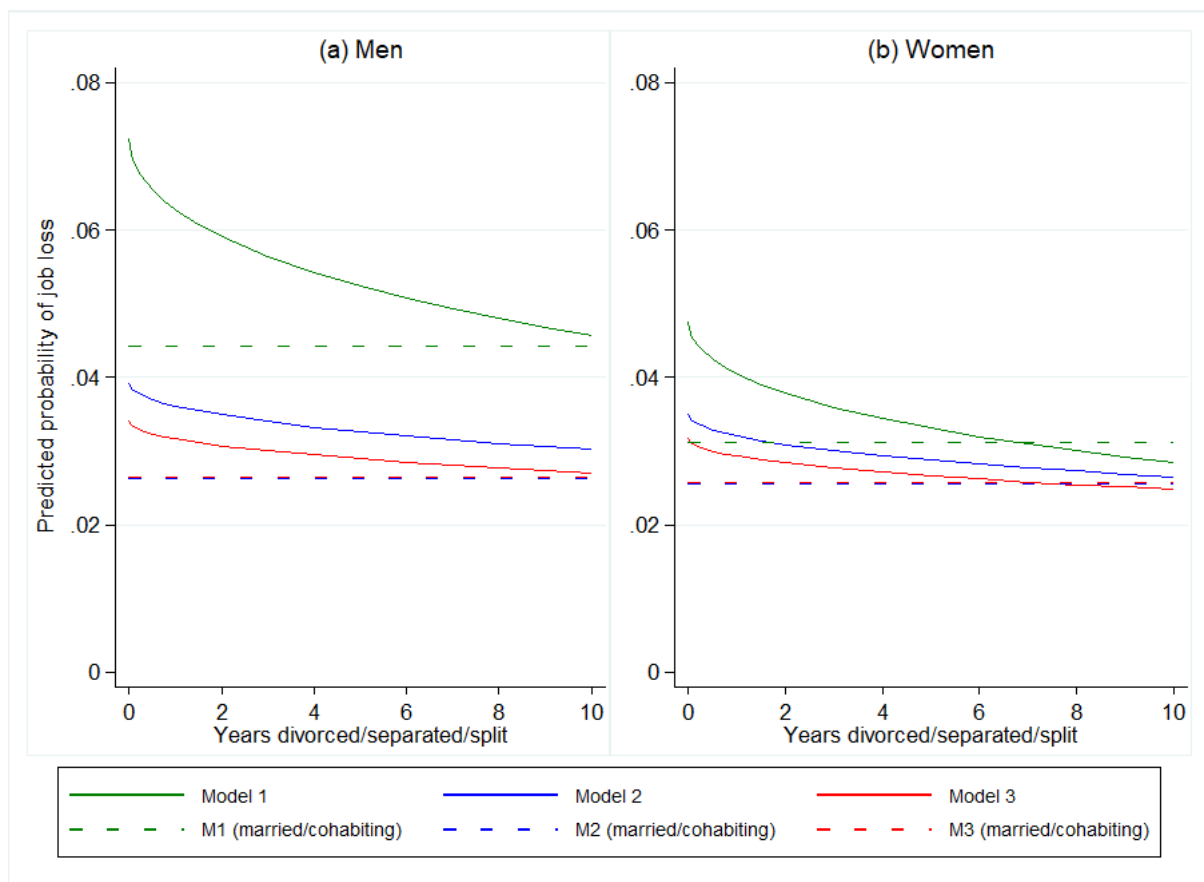


Figure S3 Predicted probability of job loss between $t-1$ and t by duration divorced/separated/split at $t-1$, using second-best-fitting functional form of duration divorced/separated/split (square root).

Note: estimates for (a) men or (b) women aged 40, of intermediate (or equivalent) social class, with A-level (or equivalent) qualifications, from the UKHLS. Compare Figure 4, which uses the *first-best*-fitting functional form of duration divorced/separated/split (natural log).

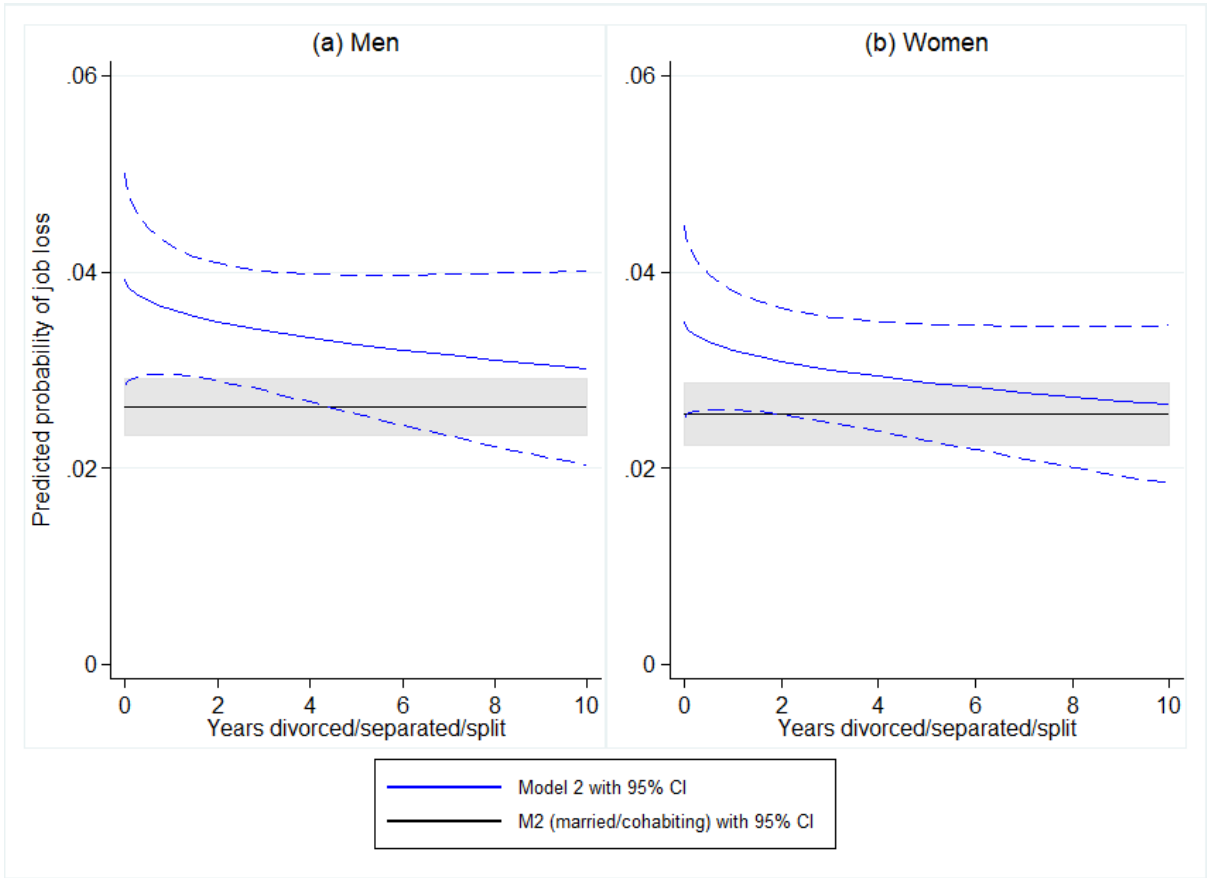


Figure S4 Model 2 from Figure S3, with 95% confidence interval.

Note: see Figure S3. Compare Figure 5.

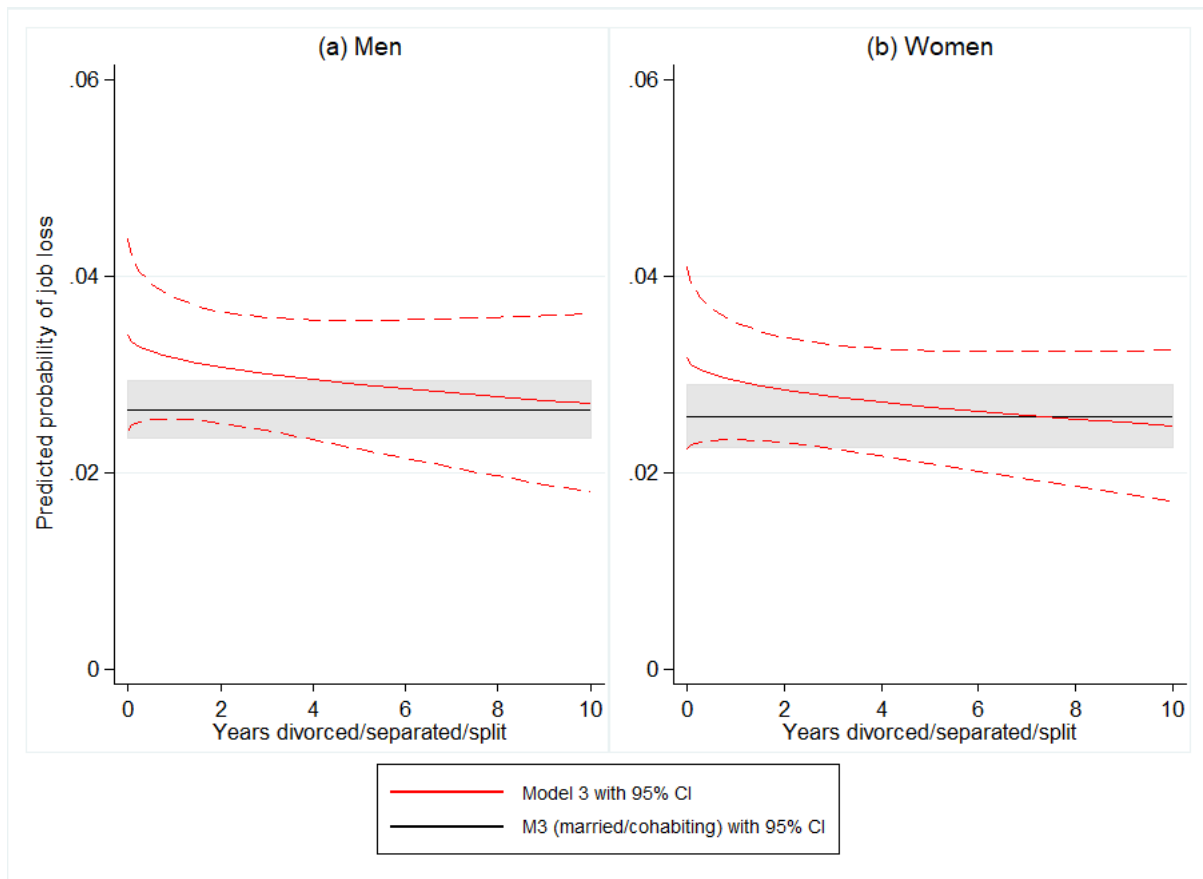


Figure S5 Model 3 from Figure S3, with 95% confidence interval.

Note: see Figure S3. Compare Figure 6.