Overcrowded Housing and Relationship Break-up

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Received: 4 December 2017 / Accepted: 20 March 2019 / Published online: 1 April 2019
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Abstract

To what extent is there an association between crowding and relationship break-up? And if so, is it a causal relationship? Housing space may affect the probability of separation because of stress, lower subjective well being, and poor mental health, any of which could put pressure on the relationship with the partner and eventually cause a break-up. Using the Luxembourgish PSELL 2003–2011, we operationalize crowding with a subjective measure. We check for the following confounding factors: financial difficulties, home ownership, nationality, and type of household member. We find that there is no significant association between crowding and separation once confounders are taken into account, not to mention causality. Instead, home ownership turns out to be of the utmost importance in explaining the bivariate association between crowding and union dissolution.

Keywords Divorce · Housing · Crowding · Spuriousness · Union dissolution

1 Introduction

Is there a bivariate association between housing density and union disruption in Luxembourg? Moreover, is it a *causal* relationship or can we explain such a bivariate association by confounding mechanisms? In this paper, I will not only see to what extent the association between overcrowded housing and union dissolution holds in Luxembourg, but I will also check to what extent the relationship is causal or spurious by using an advanced method to compare logistic regression coefficients. Jalovaara (2001, 2002) found for Finland, O'Connor et al. (1999) for England, and Krapf and Wagner (unpublished work) for Germany that couples living in overcrowded dwellings are more likely to break up a marital or cohabitational

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relationship.¹ They questioned the causality of this relationship, however. They found that other socio-economic and housing characteristics explained the bivariate association.

Examining possible determinants of divorce and separation in Luxembourg has rarely been done and is important for policy makers and scholars alike. Knowing the possible causes for relationship break-ups can help family-oriented policies alleviate the sometimes severe negative consequences of union dissolution for adults and children. Separation influences individuals' economic, social, and psychological outcomes negatively and—although it might have positive effects as well (Graff-Reed 2004)—is an event which may unsettle people and have consequences for people's functioning in society, at least in the short term (Kitson and Morgan 1990).

Housing and family histories are related to one another. The majority of the studies related to this topic focus on the consequences of family dynamics for housing careers (which describe a trajectory of housing states across the life course), in the literature referred to as the adjustment perspective and the interdependency perspective (Wagner and Mulder 2015). For instance, moves to another dwelling are usually 'upward' on the housing ladder when a union is formed or a child is born (Gambaro et al. 2017; Mulder 2006; Wagner and Mulder 2015), whereas moves are mostly 'downward' following a union dissolution (Dewilde 2008; Feijten and van Ham 2010; Mikolai and Kulu 2018; Thomas et al. 2017). Combining the life course approach with a behavioural theoretical view, Wagner and Mulder (2015) state that spatial mobility may have consequences (either planned or not) for family life.

In this paper, I focus on overcrowded housing as one aspect of the housing situation. A move towards an overcrowded dwelling can be considered a downgrade in housing quality and thus a 'downward' move. So far, scholars have studied the negative consequences of overcrowded housing on a variety of outcomes such as mental and physical health (Gove et al. 1979), suicide thoughts (Fuller et al. 1996), aggressive behaviour (Baum and Koman 1976), or marital problems [(Gove et al. 1979), although Baldassare (1983) found insignificant effects]. To our knowledge, the link between overcrowded housing and union dissolution has rarely been studied with the exceptions of Jalovaara (2001, 2002) and O'Connor et al. (1999) and the recent unpublished study of Krapf and Wagner (unpublished work). Crowding may affect the probability of divorcing directly because there might be a spill-over effect from difficulties for families living in a poorer housing situation; i.e. difficulties in housing lead to difficulties in other aspects of life (Evans and Lepore 1993; Gove et al. 1979; Wells and Harris 2007). It may also lead to lower subjective wellbeing, stress, and poor mental health (Foye 2016; Gove et al. 1979; Solari and Mare 2012; Wells and Harris 2007) because of lack of privacy (Kaya and Weber 2003; Palisi 1984) which puts pressure on the relationship with the partner and could eventually lead to a break-up. However, lack of housing space may also be related to break-up because of certain confounding or spurious factors (i.e. there is a common cause, a third factor, affecting both lack of housing space and break-up). An example may be

¹ We investigate housing effects on the dissolution of marital and cohabitational relationships and use break-up, separation, and union dissolution interchangeably when referring to these kinds of dissolutions.

Fig. 1 Conceptual model of possible explanations for bivariate association between overcrowding and union dissolution

poverty or having economic problems. In certain countries, especially those with lower economic, social, and legal divorce costs (e.g. in more generous welfare systems), the poor may be on average more likely to break up [Goode 1962; Härkönen and Dronkers 2006, but note their unexpected finding when it comes to welfare state expenditure; Matysiak et al. 2014; van Damme 2019)]. Finally, anticipation might occur. Thus, I will look to *what extent there is an association between crowding and separation and to what extent this relationship is likely to be (1) causal (i.e. crowding affects break-up, be it via the unmeasured mechanism of stress), or (2) confounded* (see Fig. 1). I will also briefly address to what extent ‘anticipation’ may play a role (arrow 3).

Luxembourg is a very peculiar case in Western Europe. It is a small country with an expensive housing market and a rather large share of home owners compared to tenants (73% in 2014) (EUROSTAT 2014). Absolute poverty is not very widespread but those that experience relative poverty form a bigger group that may be very much marginalized (Notten and De Neubourg 2011). Moreover, the likelihood that a relationship break-up is related to poverty in Luxembourg is very high (Guio 2018) which is specific to the Luxembourgish case [but note the comparison with neighbouring countries France and Germany (Nieuwenhuis and Maldonado 2018)]. The country experienced a rise in the divorce rate since the mid-seventies which then stabilized during the 2000s with a crude divorce rate (CDR) of about 2.0–2.3 (2012), before rising again recently to 2.6 (2014) (UN Statistics Division 2017). At the same time, it has a rather low proportion of people living in overcrowded housing (about 8% in 2016) (EUROSTAT 2016). Although the CDR is not the best divorce measure to compare countries,² the rate is in line with that of Finland, somewhat higher than

² Some scholars use the net divorce/marriage ratio to compare countries’ divorce rates (i.e. the Crude Divorce Rate/Crude Marriage Rate). Unlike some statistics, it is not advisable to look at the net divorce/marriage ratio in Luxembourg since this figure might be misleading: One would think that Luxembourg would be in the ‘vanguard’ of countries when it comes to divorce [having a net divorce-to-marriage ratio

in Germany in 2014, but much lower than in England (the three countries in which former studies on this topic have been done). In all three countries, the overcrowding rate is also similar to Luxembourg, even though the home ownership rate in England (about 63% in the UK in 2016) and Germany (about 53% in 2016) is much lower (than in Finland and Luxembourg around 72%). The ‘housing cost overburden rate’ (EUROSTAT 2016)³ in Germany (around 16%) and the UK (12%) is higher than in Luxembourg (9.5%) and Finland (4.4%).

To tackle the above question, I use the Luxembourg socio-economic panel (PSELL-3—Panel Socio-Economic Liewen zu Lëtzebuerg), which covers the years 2003–2014 and operationalize crowding with a subjective measure. I did not use an objective measure as this refers to housing density and does not have to imply an experience of lack of space by couples. As a result of housing density, one can either experience stress (crowding) or no stress or pathological consequences (no crowding) (Baum and Paulus 1987). Although I do not know whether couples who find their homes too small also experience stress because of that, I believe that this subjective measure comes closer to measuring crowding than an objective housing density measure would do.

A first condition for assessing causality is the correct time order between the independent variables and the dependent variable (Lazarsfeld 1955). To assess this, I take the lag of crowding. The second condition Lazarsfeld (1955) pointed out for assessing causality is that there is an association between the two variables. Indeed, I observe a statistically significant correlation. In addition, the third condition is that there should not be any confounding factors affecting the direct relationship between crowding and union dissolution. I will check for the following confounding factors: economic problems (Goode 1962), home ownership (Krapf and Wagner unpublished work), nationality (native Luxembourgish, Portuguese, or other combinations of nationality),⁴ and the type of household members (Jalovaara 2001). Those four variables are considered relevant and important in the Luxembourgish context and (apart from the household composition and nationality to some extent) are rather open to influence by policy makers (in contrast to variables such as age and marital status). To decompose the total effect of crowding on break-up into direct and confounding effects, I will use the khb approach for nested nonlinear probability (transition) models.

Footnote 2 (continued)

of 67.5 in 2013 (Eurostat)]. The reason is that the marriage rate in the country is extremely low, and (or likely because) the country has exceptionally high immigration rates.

³ The housing cost overburden rate is the percentage of the population living in households that spent 40% or more of their equivalized disposable income on housing.

⁴ About half of the Luxembourgish population is of foreign descent, and about one-sixth of the population has a Portuguese passport (the biggest group of immigrants in the country).

2 Explanations for the Bivariate Association Between Crowding and Union Dissolution

2.1 Causal Explanations

There may be two different explanations for a ‘positive’ direct (causal) relationship between crowding and separation, i.e. a separation-promoting effect of living in an overcrowded home. First, crowding can lead to an excess of interactions, stimulations, and demands from the people in the house (Evans and Lepore 1993; Gove et al. 1979; Wells and Harris 2007). This may cause social withdrawal which leads via lower social support to psychological distress (Evans and Lepore 1993; Goux and Maurin 2005). In a laboratory study with 72 college students, Evans and Lepore (1993) found that excessive, unwanted interactions (when social demands were unavoidable) go together with less eye contact and less interaction. Housemates in turn become less likely to seek and offer support to each other and this coping behaviour might be overgeneralized to other situations outside of the overcrowded house. This causes distress and such psychological distress might in turn put pressure on the relationship. A second explanation may be the lack of intimacy and possibilities for being alone (Goux and Maurin 2005), which again may affect stress and poor mental health (anxiety) (Goux and Maurin 2005; Gove et al. 1979; Wells and Harris 2007). This stress can cause lower relationship satisfaction and, as a consequence, union dissolution.

However, one can also expect a ‘negative’ relationship between crowding and separation. This is what I call the ‘lack of alternatives’ effect. From a rational perspective, spouses may be able to think of an alternative house (and spouse) they would get in case of a break-up. People living in an overcrowded dwelling will be most likely to have few options in finding better housing. As they are most likely poor, they have limited outside options and most likely would still live in an overcrowded home after a break-up (and therefore such couples choose not to break up). Note that in Luxembourg, this argument is not likely to apply as crossing the border to cheaper housing in France, Belgium, or Germany gives a reasonable outside option (but note the loss of possible social security rights built up in Luxembourg).⁵

2.2 Confounding Explanations

Four confounders are assumed to be important in explaining the association between crowding and separation. First of all, economic problems affect both overcrowded housing and union dissolution and could therefore be a reason for the bivariate association between crowding and separation.⁶ Note that the relationship between having financial difficulties and break-up is not so straightforward and does not occur in the same way in each country (Goode 1962; Jalovaara 2001; Killewald 2016; Matysiak

⁵ Commuting to work in Luxembourg from another country is very common. The country is small and distances from towns like Trier, Thionville, or Arlon are close.

⁶ On the relationship between income and housing deprivation in Luxembourg, see Fusco (2015).

et al. 2014). Conflicts over financial issues have been shown to be problematic, long lasting, recurrent, and causing more negative emotions for couples in the long run (Papp et al. 2009) as well as lower partnership quality. Also, financial problems may cause stress for each of the spouses.⁷ This can result in negative spousal interactions, which in turn reduces the coping behaviour of each partner (Krapf and Wagner unpublished work; Poortman 2005). Since Luxembourg has developed a generous welfare state, with no-fault unilateral divorce (González and Viitanen 2009), and generous single parent allowances (European Commission 2016), I expect to find a higher likelihood to separate the more a couple experiences financial difficulties as in the Luxembourgish context legal and economic barriers have been reduced over the years (see Goode 1962; Matysiak et al. 2014). Note that I will control for household income and that this financial difficulties variable thus covers more of the needs or consumption of the household, things that income does not convey.

The second confounder is home ownership. This variable might affect both overcrowded housing and separation and may therefore explain the association between crowding and separation. Homeowners live less often in an overcrowded dwelling and they are also less likely to break up because of the financial barrier they experience when doing so. Several studies on home ownership and union dissolution (Boertien and Härkönen 2018; Krapf and Wagner unpublished work) have pointed out the larger difficulties in breaking up for home owners. Such joint investments are constraints to union dissolution because they are investments that are more valuable within the current union rather than outside of it; they increase the costs (both economic and emotional) of exit out of the union. Besides having common children, home ownership is considered to be the most important form of marital and relationship-specific capital (Becker et al. 1977; Brüderl and Kalter 2001). The assumption that is made regarding the effect of joint investments is utility maximization: union dissolution takes place only in the case that the expected utility of the current union is lower than the expected utility of a certain alternative. Hence, every investment that raises the relative gain of the present union reduces the probability of a break-up. However, anticipation could also play a role: couples would only invest in a house when they expect to stay together (Lersch and Vidal 2014). In this study, I cannot rule out such anticipation for sure, although I do some sensitivity tests.

The third possible confounder is nationality. In Luxembourg, one-sixth of the population has a Portuguese background and this group is more likely to live in overcrowded houses than the native population. The question is to what extent those with a Portuguese nationality (and especially those in a mixed marriage⁸) are also more likely to break up than the native Luxembourgish population. For the moment, I do not have a specific expectation about this relationship (the crude divorce rate of Portugal is close to that of Luxembourg over the last

⁷ Note that this might be a proxy for financial stress since it is a subjective measure; a perception of the individual about their own situation.

⁸ Couples with a mixed background (whether it is e.g. education, age, ethnicity, or religion) have been found to be more likely to break-up than those from a non-mixed background (Janssen 2001). We assume the same applies to couples with heterogamous nationalities.

decade), but if such an association exists, it would be an important confounder that I would need to take into account. However, it might equally well be that confounding according to nationality does not occur as cross-cultural differences in the perception of housing density may exist. Certain cultures require more privacy than others (Kaya and Weber 2003; Palisi 1984): perhaps the native Luxembourgish prefer to live in less dense housing than the Portuguese (immigrant) population does.

The final confounder to be considered also builds upon the literature of marital-specific capital formation and investments made during the relationship (Becker et al. 1977; Brüderl and Kalter 2001). There might be a suppressor effect of having (young) children living in the dwelling (Jalovaara 2001): i.e. crowding is associated with an increased risk of separation, but this association is not observed in the ‘total effect’ because of the countervailing effect of the number of children in the dwelling, who reduce the break-up rate. The type of family members living within the household is also important because having other (adult) family members living in the dwelling might be less of a voluntary choice than having non-relatives living in (although the latter is rare in Luxembourg).

Note that as the confounders occur before crowding, I test to what extent there are spurious (or suppressor) relationships rather than mediating relationships (the mechanism of the direct effect that I suggests—via stress—is unobserved). If the latter would have been the case, then there would still be evidence of causality. When that happens, the causal effect of crowding to union dissolution runs via (some) intermediate variable(s) and it would clarify the interpretation of the effect of crowding on union dissolution. This would, however, take away some of the total causal effect by decomposing it into a direct and an indirect causal effect. Explaining the causal mechanism through which the bivariate relationship between crowding and separation comes about is not the aim of this paper though. I just want to assess to what extent the bivariate association is causal.

2.3 Anticipation

People that are anticipating upon the decision to break up may be more likely to stay in an overcrowded dwelling because they are less willing to move out of an overcrowded home for the time being. They would be less willing to make a (new) investment in the relationship. Alternatively, the couple might anticipate a move towards a bigger house and the crowding situation may be only temporary. Anticipation (of a separation or a move) could play a role, and I will check if such anticipation is likely by lagging the crowding measure two and three waves. Note that the two forms of anticipation might have opposite effects. Anticipation of a separation increases the association between crowding and breaking-up, although this is not a causal effect of crowding. Anticipation of a move decreases the association between crowding and breaking-up, and this suppresses the causal crowding effect, if it exists.

2.4 Importance of Control Variables

I also considered several other covariates: household income, women's wage ratio, age difference between the spouses, women's age, educational homogamy and heterogamy, city/rural, and employment status of the male household member. These variables are known to be related to union dissolution but are not the focus of our paper. I particularly expect that age and marital status are important controls, since older couples usually have had more opportunities to build up a successful housing career (Sierminska and Doorley 2013) but at the same time are less likely to break up [cohort effect (Bodson and Segura 2010)]. Married couples would be more likely to make joint financial investments (Lersch and Vidal 2014) (and buy a bigger house), and they are less likely to dissolve their union than cohabitational partners (Liefbroer and Dourleijn 2006).⁹

3 Data and Measures

3.1 Data

To investigate to what extent there is a relationship between crowding and break-up and to what extent I can explain this association by confounding, I use the Luxembourgish PSELL. This is a panel survey on living conditions of households in Luxembourg. Interviews were held with about 10,000 individuals in each yearly wave (starting in 2003). These numbers increase from wave 8 (2010) onwards as from then on the panel became a rotational panel and the first rotational group was added (N rotation group = 3715). I analyse wave 1–9 since for wave 10–12 the main independent variable (crowding) was not asked. The unit of analysis is the couple, and I use information of both spouses to assess whether a break-up of the relationship took place. I analyse break-ups [coded 0 (partnered), 1 (separated)] from both marriages and cohabitations, and the break-ups can be (not yet) official divorces or break-ups from cohabitational relationships. To keep it simple I only look at first union dissolutions,¹⁰ observed during the course of the panel, leaving out 10 cases of a total of 534 observed separation events. Widow(er)s are excluded. The initial sample covers 20,342 couple-years in the age of 18–65; 9673 couples. The sample is reduced by about 27% after deletion of missing values on any of the independent variables. The final analytical sample covers 14,843 couple-years and 6620 couples. Attrition happened less frequent among those couples that were divorced. On average, attrition was 18%, whereas it was 17% among those that have as marital status 'divorced'. Attrition information about cohabitational break-ups could not be derived.

⁹ According to the diffusion hypotheses of Liefbroer and Dourleijn (2006), countries with a small proportion of cohabitators (in the Luxembourgish PSELL this proportion is 16%) show a 'positive' effect of cohabitation on the risk of union dissolution. This is due to the fact that cohabitators in such societies are a selected group with more modern values than married couples.

¹⁰ This is 1.6% in each wave (3.6% between-averages per wave), which is comparable to the wavelly number of separations in the BHPS/Understanding Society Panels in the UK (about 1–2%).

3.2 Measures

I analyse the possible influence of a subjective housing density measure, which is measured according to the following question: is your dwelling for your household too small; too big; or about right? Considering one's dwelling as too small is coded to be crowded (code 1). Note that this question was not asked in 2009. The scores are imputed where possible in 2009 based on the information in the neighbouring waves from 2008 and 2010. When a change in the crowding situation between 2008 and 2010 occurred, the value for imputation was taken from wave 2008.

The confounders are measured in the following way: financial difficulties are captured with the following question: with respect to your budget, could you tell me which of the following categories applies most to your case? (1) you have ample financial resources (ref cat); (2) it's ok; (3) the budget is tight; (4) difficult to make ends meet. Home ownership is based on the following question: is the first responsible of the dwelling: (1) owner of an own built house; (2) owner of a bought dwelling; (3) owner of an inherited house; (4) renter or subletter (according to the market price); (5) renter or subletter (below market price); (6) having free housing? A dummy is created for those being home owners (1) (score 1–3) or not (0) (score 4–6). The nationality of the couple is constructed as follows: (1) both are Luxembourgish; (2) both are Portuguese; (3) Luxembourgish/Portuguese; (4) all other (ref cat). Finally, I also consider the type of household members. I include three variables: 1. having at least one other adult (age 18+) in the home (next to the couple); 2 the number of children between the age of 0 and 11; 3 the number of children between the age of 12 and 17.

The other concomitant variables that I will investigate are: whether the couple is married or cohabiting, relative education (homogamy and heterogamy), age difference of the couple, women's age, women's wage ratio (her wage compared to that of her spouse), log of household income, whether the male household member is unemployed, city/rural area of living.¹¹

4 Analytical Approach

I perform transition models estimating the log odds of union dissolution in each year using a logistic regression and try to explain these by crowding and some covariates. Note that I lag all independent variables one wave. Unfortunately, the PSELL does not have the starting dates of many relationships, so I could not control for union duration in our models (but see one of the sensitivity checks later on). To break down the total association between crowding and separation into a direct effect and the indirect effects of confounding factors, I use the khb approach (Karlson–Holm–Breen) for nested nonlinear probability models (Breen et al. 2013; Karlson et al. 2012). This technique (see for an application Breen and Karlson 2014)

¹¹ We also considered including (poor) health of the household head into the model, but this can be a mediator. Hence, we decided to leave it out.

takes into account the rescaling of the variance of the dichotomous-dependent variable¹² when more variables are introduced into the model and hence decomposes the total effect into a confounding and a rescaling effect. The khb method includes the residual of the confounding variable after taking the overlap with the key independent variable into account rather than the confounding variable itself.¹³ By doing so, the method rescales the reduced equation to the scale of the full equation and therefore, the coefficients of the independent variable in the two models (reduced and full) can be subtracted from each other to get the direct effect. The method thus holds the error distribution constant between the full and the reduced model [which is the model without the confounder(s)]. Hence, this method is unaffected by rescaling (i.e. changes in the variance of the error distribution) *and* by the changes in the shape of the error distribution across nested models. (I will thus estimate separate reduced models, each reduced model is made comparable to the relevant full model) Other methods, such as naive estimation of the confounding effect (by just comparing odds ratios of nested models)—which leads to an underestimation of confounding,—Y-standardization, average predicted estimates (marginal effects), and linear probability models do not have this advantage. The last three do take rescaling into account, but they perform less well when the difference between the full and reduced error distributions becomes greater (Karlson et al. 2012). I corrected the standard errors for clustering due to repeated observations within individuals.

5 Results

5.1 Descriptive Statistics

In Table 1, I provide some descriptive statistics (between-couple averages per wave). I observe a separation of couples only in 3.5% of the cases on average per wave; 20% of the couples lives in a subjectively overcrowded dwelling; couples on average do not experience financial difficulties, but in 8% of the cases they do; 69% are home owners; 20% of partners are both Portuguese; 39% are both native Luxembourgish, only 2% are mixed Luxembourgish/Portuguese, and 40% constitute the rest of the marriages/cohabiting relationships, either of mixed or the same nationality. For 23% of the couples at least one other adult lives in the dwelling (note that the majority is an independent child or son/daughter-in-law). 49% of the households have no children, 31% have at least one child in the age between 0 and 11, and 21% have at least one in the age of 12–17.

¹² Because the logistic regression is a latent dependent variable model, the variance of the dependent variable is not fixed and the estimator for the regression coefficients requires an assumption about the distribution and the variance of the error terms in particular (Karlson et al. 2012; Mood 2010). The regression coefficients of the full and the reduced model (the model without confounders) are therefore a combination of the true regression coefficients and a rescaling factor.

¹³ Note that the concomitant variables are just control variables, in the sense they are included in both the reduced and the full model, but their residual is not calculated and included in the reduced model.

Table 1 Descriptive statistics of the main variables to be analysed (between-averages per wave, analytical sample)

	%
Separated	3.5
Home is too small	20
Financial difficulties: ample	40
Financial difficulties: ok	54
Financial difficulties: tight	33
Financial difficulties: difficult	8
Home ownership	69
Nationality: both Portuguese	20
Nationality: both Luxembourgish	39
Nationality: Luxembourgish/Portuguese	2.3
Nationality: all other	40
At least one other adult in the dwelling	23
At least one child in the dwelling	51
At least one child age 0–11	31
At least one child age 12–17	21
<i>N</i> couples	6620
<i>N</i> couple-years	14,843

Table 2 The bivariate relationship between crowding (lagged) and union dissolution (row percentages)

	Intact relationship	Break-up	<i>N</i> years
No crowding	99	1	12,802
Crowding	98	2	2041
Odds ratio	1.77***		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, one-tailed test

The bivariate relationship between the lagged value of the crowding measure and union dissolution is shown in the cross tabulation in Table 2. The table shows that living in an overcrowded home goes together with a larger likelihood of breaking up. The odds ratio is statistically significant at a 99% level ($p < 0.001$). Note that this is a very crude way of assessing the association between the two variables since I do not yet take dependency between the observations among the different years (panel waves) into account.

5.2 Khb Decomposition Results

I now perform the khb analyses, examining the part of the total association between crowding and separation that is due to confounding. The results are presented in Fig. 2. When considering the reduced model (without any confounders or concomitant variables included), the log odds of separation are [$\exp(0.572) = 1.77$] for couples living in an overcrowded house, (which is statistically significant). This is the bivariate, total relationship between crowding and

Fig. 2 Khb analyses comparing the reduced (null) model of subjective housing density (bivariate) to the full models including more than only the bivariate relationship by controlling for either several covariates and/or including confounders. The khb approach requires at least one extra variable to be included to compare the reduced model (bivariate relationship of crowding with union dissolution + the *residuals* of the relevant confounding variables that are included in the full model) with the full model (the remaining direct relationship of crowding and union dissolution after taking confounding into account). The full models add the following variables to crowding in the models: only extra adult (*M0*), the four confounders without controls (*M1*); other adult, controls (*M2*); financial difficulties alone, controls (*M3*); home ownership alone, controls (*M4*); nationality alone, controls (*M5*); type of household member alone (other adult, nr of children age 0–11, nr of children age 12–17 in the dwelling), controls (*M6*); and all confounders together, controls (*M7*). Logit coefficients with 90% confidence intervals (for a conservative one-tailed estimation of the relationship between crowding and break-up)

separation (*M0*). This coefficient reduces hardly when including whether another adult is living in the dwelling (*M0* full model). However, when including all four confounders together, the log odds of separation decrease to $[\exp(0.246)=1.28]$ (which is not statistically significant anymore at a 5% one-tailed test) (*M1* full model). Control variables have a similar influence, but because of rescaling, the bivariate relationship of the reduced model also decreases [to $\exp(0.251)=1.29]$ (*M2* reduced model). When taking control variables into account the log odds of separation are still $[\exp(0.251)=1.29]$ (*M2* full model). The most important controls are women's age and being married. As these are couple characteristics that are hard for policy makers to influence, I do not zoom in further on these effects. Moreover, about just as large a contribution to the total effect of crowding on separation is achieved by the four possible confounding variables I consider explicitly. Disentangling the effects of these four confounders gives the following results: financial difficulties reduces the crowding effect to $[\exp(0.239)=1.27]$

Table 3 KHB analyses decomposing the total association between crowding and separation into a confounding (indirect) effect and a remaining direct effect

	Logit coefficient	S.E.	%	Overall % from variable
Total effect (controlled)	0.266	0.177		
Direct effect crowding	0.173	0.187		
Indirect effect crowding	0.093	0.050		
From financial difficulties				3.3
From financial difficulties: ok	− 0.013	0.016	− 4.8	
From financial difficulties: tight	0.012	0.016	4.6	
From financial difficulties: very difficult	0.009	0.022	3.5	
From home ownership	0.093***	0.033	35	35
From nationality				4.4
From nationality: both Portuguese	− 0.008	0.006	− 3.0	
From nationality: both Luxembourgish	0.017	0.014	6.4	
From nationality: Luxembourgish/Portuguese	0.003	0.003	1.0	
From type of household member				− 7.7
From type of household member: other adult	− 0.000	0.001	− 0.1	
From type of household member: nr of children age 0–11	− 0.021	0.027	− 8.0	
From type of household member: nr of children age 12–17	0.001	0.011	0.4	
N	14,843			
Chi ² (df)	141 (22)***			

Logits and relative measures (confounding percentages)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, one-tailed test

(controlled) (*M3* full model). The effect decreases when home ownership and controls are taken into account [$\exp(0.169) = 1.18$] (statistically insignificant) (*M4* full model); nationality reduces it to [$\exp(0.237) = 1.27$] (*M5* full model); The type of household members does not confound the controlled relationship between crowding and separation [$\exp(0.277) = 1.32$] (compare Reduced and Full models *M6*), but suppresses the association. This applies to dwellings with children of age 0–11: in such dwellings, crowding occurs more often and breaking up is less common. The result of these two opposing associations is that the relationship between crowding and separation is suppressed (reduced) when one does not take into account the number of young children in the household. Finally, adding all four possible confounders and the concomitant control variables to the model reduces the coefficient of crowding in total [$\exp(0.173) = 1.19$] (despite the small suppressor effect of young children in the dwelling) (*M7* full model).

As stated before, I am particularly interested in the confounding contribution of four variables: financial difficulties, home ownership, nationality, and type of household members as these four variables are considered of utmost importance in the Luxembourgish context. I therefore zoom in on these four variables

and disentangle the total effect of crowding from possible indirect confounding effects from these variables. In Table 3, the contribution of each of the confounding factors to the total association is expressed in percentages (based on Model 7). +3.3% of the total association between crowding and union dissolution is explained by confounding through financial difficulties couples are experiencing. For home ownership, this percentage is +35%, for nationality it is +4.4%, and for type of household member -7.7% . Hence, overall the biggest confounder turns out to be home ownership. Homeowners are much less likely to live in an overcrowded home than renters, and they are also much less likely to dissolve their marital or cohabitational union. I find somewhat larger percentages for all variables once not controlling for other concomitant variables, although the suppressor effect of young children reduces then to -1.1% . Results are available on request.

5.3 Sensitivity Checks

I did several procedures to check how sensitive the results were to certain decisions I made. None of the checks point to a different conclusion. Results are available upon request. (1) I did an event history analysis for only married couples where I could take into account union duration. The disadvantage of such an analysis is that the sample is more select, leaving out cohabiting couples (16%). In addition, with this event history analyses I am not able to decompose the total association between crowding and breaking up into direct and confounding effects, because I do not have a measurement of crowding and other independent variables across the entire union duration. I find that the effect of union duration becomes less significant the more concomitant variables I add. Also, the effect of crowding reduces a lot after taking into account the four confounders and is statistically insignificant (but note that I cannot compare these nested full and reduced binary response models without scaling corrections); (2) I tried to estimate models in which I only analyse couples that I observe forming a relationship during the panel, but these would lead to a bias in the results as I can observe a maximum duration of 8 years (the duration of the panel until 2011). In addition, I observed only one couple that was formed during the panel, who separated and was living in an overcrowded home the wave before. I could therefore not perform our analyses on the sample of couples that has formed their relationship during the panel; (3) I did a fixed effect analyses to control for person stable preferences for flexibility versus stability in housing and family careers. The findings are that a change towards crowding has a statistically non-significant effect and a change in $\log(\text{household income})$ a positive significant effect on relationship break-up. Also a change to having at least one child in the age of 12–17 in the dwelling increases the likelihood to break up; (4) I also did all main analyses using three common objective (continuous) crowding measures: (a) I used the objective indicator of the Housing Observatory, department of the Ministry of Housing (2017) in Luxembourg, and EUROSTAT (2016)), which is a dummy for whether or not the number of rooms¹⁴ needed exceeds the number of rooms that are present

¹⁴ Without the kitchen, bathroom, outbuildings, or study/work rooms.

in the dwelling. The need is different for different household members according to their gender and age and is as follows: (1) one room for the household; (2) one room for each couple; (3) one room for each single person 18+; (4) one room for two single persons of the same sex between 12 and 17; (5) one room for each single person of different sex between 12 and 17; (6) one room for two children under 12.; (b) I divided the number of rooms needed (based on the just mentioned age and sex specific composition of the household) by the number of rooms present in the household. This gives us a continuous measure; (c) The logged square metres of the (livable) floor space of the dwelling divided by the number of people in a household (note that this measure is actually capturing non-dense living circumstances: correlation with crowding is -0.41). Results were similar for all three measures and in line with our general finding that home ownership is the main important confounder. The only difference with the findings for the subjective housing density measure was that nationality suppressed the relationship between objective housing density and break-up. Those couples in which both spouses are Portuguese are less likely to break up and are more likely to live in a dense home than couples from other backgrounds. The result of these contradictory signs of the relationships suppresses the 'positive' relationship between housing density and separation meaning that the association between housing density and separation is actually a bit stronger than observed when not taking the nationality of the couple into account; (5) I checked for anticipation occurring by lagging the crowding measure two and three waves. I find that the total effect of crowding is statistically insignificant in both cases, hence anticipation of a separation is less likely to occur. Note that the couple might still anticipate upon a move; (6) I also examined the influence of an objective measure of poverty (50% of the median income) instead of the subjective financial difficulties measure. The results are similar; (7) With respect to the imputation of crowding in wave 2009, I imputed a change in the value from 2008 to 2010 with the value of 2010 instead of the value of 2008. Results are in line with the main findings, but the confounding by home ownership and suppression by young children was slightly higher.

6 Conclusion

This paper contributes to the literature on the intersection of housing and family life courses in that it looks at potential negative outcomes of living in an overcrowded dwelling. I examined to what extent there might be a causal relationship between subjective housing density and union dissolution. It might be that there exists such a causal effect, which (for instance) can be explained by stress of the household members that live in an overcrowded home (via either social withdrawal or lack of privacy). However, based on our khb analyses, I draw the conclusion that it is very unlikely that there is a causal direct effect from crowding on separation. Instead, the khb analyses show that home ownership is the most important confounder of the association between crowding and break-up. This result is in line with the findings of Jalovaara (2001, 2002), O'Connor et al. (1999) and Krapf and Wagner (unpublished work). Note that this spurious effect remains present after including a number of

covariates. Home ownership can be considered one of the most important forms of relationship capital and therefore a barrier to break-up (Becker et al. 1977; Brüderl and Kalter 2001). Note that I cannot fully rule out anticipation in the khb analyses (although I lagged all independent variables two and three waves), meaning that couples might anticipate upon a break-up by not investing anymore in their relationship (Becker et al. 1977) by buying a house. A way to control for this would have been to include relationship problems as a proxy for the perceived break-up probability of spouses in the model and in this way, the unbiased direct effect of home ownership could be identified. Estimating the probability to experience a marital break-up, Brüderl and Kalter (2001) have shown that even though marital problems lead to lower joint investments in the relationship (i.e. having common children and joint home ownership), endogeneity does not play a role in the relationship between marital-specific capital and divorce. Introduction of marital problems in their model did not affect the direct effects of common children and home ownership on divorce. Hence, joint investments such as home ownership seem to be ‘ties that bind’ even though the couple suffers from marital problems (Brüderl and Kalter 2001: p. 418). Boertien and Härkönen (2018) came to the same conclusion after investigating the effect of marital satisfaction and barriers on divorce in the UK. I did check to what extent a two wave lagged variable of home ownership related to separation, but I found a strong negative association between (two wave lagged) home ownership and break-up as well as a confounding effect of (two wave lagged) home ownership. The confounding effect of a three years lagged home ownership variable is very small. Thus, overall, it seems that there is something in home ownership that withholds couples from breaking up in the short term. ‘Home-making’¹⁵ may be one reason for this, investment another (André et al. 2017). In other words, both investment in the home (owning a—non-crowded—dwelling) and investment in the relationship (relationship-specific capital) go together. Home ownership may delay the decision to break up, or it simply may be difficult to arrange separate homes after union dissolution actually took place, but this is not reflected in the data yet because one or both of the partners did not move out yet.

Another anticipation argument may be that couples that are about to break up start to consider their home as being too small. For instance, when I defined the sample according to the strongest association between subjective overcrowded housing and a break-up, I had to look at the native Luxembourgish population of homeowners. For that subsample, I did find a strong bivariate relationship that was hard to be explained away ($N=53$ separation events of whom 9 claimed to live in an overcrowded house). Of these people, however, no one was living in financial difficulties, they did not have any other adults living in their households, and most importantly, none of them was living in an objectively defined overcrowded house. The only remarkable difference of this group of people compared to those that do not break up seemed to be that they are very young couples at the beginning of their housing career. (So they probably did not invest that much in their house.)

¹⁵ Meaning that the house is seen as a place of self-expression, which is made a place of one’s own, which provides security and stability (André et al. 2017).

Another remark could be made about the distinction between sole home ownership and joint home ownership. It could be expected that the latter would be more of an indication of joint investment in the relationship than the first one. However, Krapf and Wagner (unpublished work) found no statistically significant distinction between the two with respect to the risk of union dissolution. The authors interpret this finding in two ways: the investment of one spouse in the union through home ownership may be a strong signal of commitment, or in many cases both partners may have invested in the home, while only one partner is registered as owner. In this study, I was not able to check this since I do not have information regarding sole or joint home ownership but only whether the household head (the one responsible for the home) is a home owner or not.

To conclude, what does the concept of home ownership entail? Home ownership is an indication of social-economic status, which partly reflects long-term income protection and is a symbol of status and success. Kurz and Blossfeld (2004) show in their book that labour market position affects the likelihood to become a homeowner in twelve welfare states. Note that I controlled for the (un)employment status of the male household member of the main couple in the household. Nevertheless, it remains likely that home ownership as a common cause of both lack of crowding and lack of break-up probability is relevant. Although home ownership may relate to (long term) social-economic status, which in turn affects both crowding and breaking up negatively, I did control for several social-economic factors (education, employment status male couple member). Hence, in Luxembourg, differences between homeowners and renters reflect social-economic differences *beyond* these factors, and inequality between these groups prevails both in housing quality and in the experience of a demographic life event such as relationship break-up. Such an alternative common cause explanation may be that there is a large intergenerational transmission of home ownership taking place in Luxembourg, just as has been found for other European countries (Lersch and Luijkx 2015). Lersch and Luijkx find a socialization effect that is explaining the intergenerational transmission of home ownership (due to, for example, knowledge transfer, learned life-style aspirations, taste for home ownership, and risk preferences), but there might be additional mechanisms such as financial help from parents, living close to parents, and SES intergenerational transmission. These factors are not only related to the intergenerational transmission of home ownership but also play a role in explaining separation (be it sometimes positively instead of negatively (the remaining effect of home ownership on breaking up that has been found in this paper is negative). More economic parental resources (that go together with more home ownership) are assumed to be related to break-up, either positively (parents can help in costly divorce) or negatively (parents financial support reduces financial stress of the couple) (Brons and Härkönen 2018); living close to parents [which increases the likelihood of intergenerational transmission of home ownership, e.g. due to housing market similarities (Mulder et al. 2015)] can imply a tighter social network with more social pressure to stay together (Högnäs and Carlson 2010); and higher parental SES couples are found to be more likely to break up, at least in the Netherlands (De Graaf and Kalmijn 2006). Note that this last finding actually would suppress

the relationship between home ownership and separation. Lersch and Luijkx also identified a transmission of wealth among generations of homeowners compared to renters, which could also be a common cause of home ownership and breaking up. All of this suggests that more research in Luxembourg on inequalities between owners and renters should be focused on the impact of parental background.

Acknowledgements I would like to thank Matthias Kuepie and Laureen Vanni for their help with the data at various stages of the data manipulation and analyses. I would also like to thank Stéfanie André, Marie-Sophie Callens, Alessio Fusco, Amparo Nagore Garcia, Julien Licheron, Andrea Mercatanti, Javier Oliviera, and Alex Theloudis for their valuable comments and suggestions.

Funding The author did not receive any funding for this study.

Compliance with Ethical Standards

Conflict of interest The author declares that she has no conflict of interest.

Appendix

See Table 4.

Table 4 Descriptive statistics of the concomitant variables (between-averages per wave, analytical sample)

	Mean/percentage	Standard deviation
Log household income	11	0.51
Both partners high educated	19	
Both partners mid educated	19	
Both partners low educated	28	
Hypergamous couple	24	
Hypogamous couple	16	
Age difference (men's age—women's age)	3.0	5.2
Female age	42	11
Wage ratio [women's wage/(women's wage + men's wage)]	0.26	0.28
Male household head unemployed	11	
Living in Luxembourg city	16	
Living in Esch-sur-Alzette	8.6	
Living in rural area or small city	78	
<i>N</i> couples	6620	
<i>N</i> couple-years	14,843	

Note that the categories belonging to the same variable do not need to add up to 100% because these are between-averages, not overall-averages

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