

# INCOME, WEALTH AND THE MARITAL DISSOLUTION PROCESS: EXAMINING THE IMPACT OF NON- RESPONSE AND SAMPLE DESIGN ISSUES FOR WOMEN AND MEN

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## NON-TECHNICAL SUMMARY

Marital dissolution is associated with many changes in the lives of family members. To fully understand these changes researchers need access to surveys that collect data on the same individuals over time, usually referred to as panel surveys. Such data enable examination of marital dissolution as a process that occurs over time with couples going through a number of stages including preparing to separate, separation, legal divorce and repartnering. We know that marital dissolution has a big impact in relation to economic wellbeing with evidence that women fare much worse than men in these areas following marital breakdown. In this paper we use panel data from Australia to examine the changes in income and wealth for women and men in relation to marital dissolution.

We use statistical models suited for data with repeated observations on the same individuals. Panel surveys aim to interview the same people on a regular basis, but often fail to reach all members as some may refuse to be re-interviewed or are unable to be contacted. Weights can be used to rebalance the participating sample when other sample members do not participate. Panel surveys also need to devise rules about which members of the households to follow when children are born or households break up and sample members form new households. The rules developed to respond to these events have important implications for modelling techniques and the reliability of results. Many researchers ignore these issues but in our paper we explicitly examine how they affect our results.

We examine four stages of marital dissolution. We find that women experience much greater financial loss than men, but lower educated women experience higher personal income gains during the period of separation and divorce than higher educated women. Most of these gains are sustained through subsequent repartnering. Our results are broadly robust to variations in sample design and non-response. Nevertheless, there are some differences that alter the conclusions when the sample is weighted or restricted to the original sample.



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## ABSTRACT

Panel surveys are often used to measure the economic consequences of marriage dissolution, such as changes in income and wealth. Previous research indicates that there are differences in the consequences for men and women. Few studies examine marital dissolution as a dynamic event or consider if there are differences in results due to non-response or sample design issues. We use panel data from Australia to model the changes in income and wealth with marital dissolution via a fixed effects model. We examine four stages of marital dissolution and five alternative model constructs that take account of various aspects of sample design or non-response. We find that women experience much greater financial loss than men, but lower educated women experience higher personal income gains during the period of separation and divorce than higher educated women. Most of these gains are sustained through subsequent repartnering. Our results are broadly robust to variations in sample design and non-response. Nevertheless, there are some differences between the weighted and unweighted models that alter the conclusions and not just through larger standard errors. There are also some small differences identified when the sample is restricted to the original sample.

Keywords: Divorce; economic consequences; HILDA Survey; attrition; panel survey design

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## 1. Introduction

Marital dissolution has significant economic consequences for the separating partners (Andreß et al. 2006; de Vaus et al. 2017; Duncan & Hoffman 1985). Most studies focus on change in income as a result of separation or divorce (Zagorsky 2005). Income changes however only reveal a portion of the economic changes that occur during this transition period. Accompanying changes also occur in expenditure patterns (such as setting up a new household, reduced economies of scale, and legal costs) and the composition and amount of wealth (such as the sale of the family home and the use of savings). Considering the changes in wealth, in addition to income, due to marital dissolution provides a more complete picture of the impact of marital dissolution on individuals.

It is also important to consider how economic consequences vary across groups. There is evidence of declining rates of divorce amongst more highly educated groups (McErlean 2021). What is less clear however, is how education affects the experience of divorce. It is possible that the negative impact of divorce may be more acutely experienced amongst those with less bargaining power and fewer opportunities in the labour market, thereby compounding the effects of an already negative life course event. This implies that not only is divorce more likely amongst those with less education, but also that the effects on income and wealth may be more severe for these groups.

Recent research has also shown that it is important to investigate marital breakdown as a dynamic process unfolding over a period of time rather than a single point in time event (Kapelle & Baxter 2021). This requires longitudinal data examining the consequences of relationship changes on income and wealth across several stages including prior to separation, after separation, after legal divorce and after repartnering. This research must rely on panel survey data which can have complex sample designs, both at the outset and through the use of following rules and the addition of refreshment samples (Smith et al.



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2009; Watson 2022; Watson & Lynn 2021), and are subject to attrition (Fitzgerald et al. 1998; Spiess & Kroh 2008; Uhlig 2008; Watson & Wooden 2009).

This paper provides new evidence on the impact of marital dissolution on economic outcomes using recent Australian data. First, we examine changes in both income and wealth with marital dissolution. Second, we use high quality longitudinal data that enables assessment of outcomes for several stages in the marital dissolution process. Third, we examine variations in outcomes across education levels to understand how outcomes vary across groups. Finally, we make several methodological contributions by examining the robustness of the results to sample design and non-response issues.

## 2. Background

Andreß and colleagues (2006) undertook a review of twelve studies of the impact of separation and divorce on adjusted household income in Europe (specifically Belgium, Denmark, Germany, Italy, Netherlands, Sweden, and the United Kingdom) and North America (United States and Canada). They found that income losses were not felt equally by both partners (the review included, among others, work by Burkhauser et al. (1990, 1991); DiPrete and McManus (2000); Jarvis and Jenkins (1999); Uunk (2004)). Women's income losses were sizeable while men experienced only moderate income losses or even improvements to their income. Women lost 10 to 24 percentage points more of their income compared to men.

In their own analysis of separations across five European countries, Andreß and colleagues (2006) confirm these findings and further found that women with children were much more affected than women without children. This is because children usually live with their mother post separation and therefore restrict the mother's ability to work. The availability of public childcare and the generosity of the social security system impact how mothers navigate the labour market during this time. On average, it takes



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eight years (in Britain) to 15 years (in Belgium) after separation for women to regain their pre-separation income. Recovery times were much longer when the women did not repartner.

In Australia, de Vaus et al. (2014) also find that separation has a substantial negative impact on the equivalised household income of women but they recover to the level of their married counterparts after six years. This stands in contrast to separated men who tend to experience greater increases to their equivalised household income than their married counterparts. In a study of six OECD countries, de Vaus and colleagues (2017) find that the extent and duration of the negative effects of separation and divorce, especially for women, in different countries are heavily affected by the social security system, labour markets, family law system, child support, spousal maintenance and the extent of repartnering.

The analysis of changes to wealth following marital dissolution deepens our understanding of the economic consequences of divorce. The 1979 cohort of the US National Longitudinal Survey of Youth (of people aged 14-22 in 1979, so aged 35-43 in 2000) has collected annual wealth data since 1985. Using 16 waves of wealth data, Zagorsky (2005) finds that the wealth of married individuals (assumed to be shared equally between partners) increased by 16% a year, compared to single individuals whose wealth increased by 8% a year. Divorced individuals had an initial drop in their wealth by 77% but then had a subsequent 14% increase in their wealth each year. They find very small differences by gender in this cohort.

Complementary to this, Lin and Brown (2020) use the 2004, 2010 and 2014 waves of the US Health and Retirement Study (HRS) of people aged 51 and over. They find significant total household wealth losses of about 50% for both divorced men and women, as would be expected if wealth is shared equally between partners. These losses persist over time. Subsequent repartnering only substantially recovered these losses for women.



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The German Socio-Economic Panel (SOEP) asks each individual about their share of various wealth assets and debts. This provides insights to how wealth is shared between couples prior to separation. Grabka et al. (2013) examined the wealth gap of partnered couples (married and defacto) in the SOEP sample and found that in 29% of couples women reported owning more than men, in 19% of couples they had (exactly) equal wealth ownership, and in 52% of couples men reported owning more than women. They find that being self-employed, recently receiving an inheritance and being in charge of the household finances contributes to the gap (reduces it for women and increases it for men).

Also using the SOEP data but focusing on the effects of marital dissolution on wealth, Kapelle and Baxter (2021) find that both men and women experienced substantial personal wealth losses during separation that was not recovered six or more years after divorce. This was mostly driven by losses in housing wealth. Interestingly separation from a cohabiting union shows different outcomes. Data from the SOEP shows that men and women lose similar amounts of wealth following marital dissolution, but women lose considerably more wealth than men following cohabitation breakdown (Boertien & Lersch 2021). The authors attribute this to gender differences in wealth at the time of separation, rather than differences in post-dissolution processes. They further argue that legal costs associated with marital dissolution may explain why men lose more wealth following marital breakdown compared to cohabitation breakdown.

In Australia, panel data on wealth was first collected in 2002 in the Household, Income and Labour Dynamics in Australia (HILDA) Survey. This wealth module has been repeated every four years since with five waves of wealth data now available. Some questions are asked of one person at the household-level whereas others are asked at the individual level where one person was unlikely to adequately answer on behalf of all members in the household (Headey et al. 2004). This type of wealth data, which includes at least some items collected at the individual level, allows for a more in-depth study of the changes in wealth with marital dissolution than when using cross-sectional data or with panel data collected only at the household level. Nevertheless, research in this space is sparse. Hendershott et al. (2009) used the first





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wave of wealth data to examine associations between marital history and non-pension wealth. They found that among people aged 35 and older, couples accumulated more wealth per person than unpartnered individuals and those who had ever been divorced held about 8% less wealth than others. We are aware of only one other Australian study that considers the change in median net household wealth and per capita wealth for divorcees compared to non-divorcees (de Vaus et al. 2014). However, their analysis is descriptive only and does not adjust for differences in the composition of the subgroups.

We draw on this previous research in several ways to extend knowledge and fill gaps. First we adopt the approach advanced by Kapelle and Baxter (2021) that marital dissolution is a dynamic process with distinct stages. Almost all of the studies on the change in income or wealth as a result of a separation or divorce examines marital dissolution as a point in time event (for example, counting the time to or from separation / divorce) rather than it being considered a process through which a person moves, potentially at a different rate to other people experiencing marital dissolution. This paper builds on this earlier work by explicitly examining the impact of repartnering on income and wealth changes.

The second contribution is in relation to education. As mentioned earlier, McErlean (2021) demonstrated differences in divorce rates by education level. It may be possible that their experience of marital dissolution with respect to income and wealth is also different. Nevertheless, researchers tend to include education as a covariate in their model of income or wealth which allows for a constant shift in the dependent variable (Andreß et al. 2006; de Vaus et al. 2017; Uunk 2004). Instead, in this paper, an indicator of high education (defined as having a university degree or not) is interacted with the various marital dissolution stages. This shows whether the experience of those with low education are comparable to those with high education throughout the marital dissolution stages. It is not obvious which way higher education will influence the results. On the one hand, a university degree may result in the individual having better bargaining skills, but on the other hand it will mean they are likely to have greater future earnings so they may not need to bargain so hard over the property settlement.



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The third contribution this paper makes is in examining how the results change when non-response and sample design issues are accounted for. Some of the earlier income studies (for example, Burkhauser et al. 1990, 1991; Jarvis & Jenkins 1999) simply compare weighted medians before and after separation and do not control for the different characteristics of people who experience marital dissolution. More recent studies model the change in income and wealth with marital dissolution, controlling for a range of characteristics (for example, Andreß et al. 2006; de Vaus et al. 2017; DiPrete & McManus 2000; Kapelle & Baxter 2021; Uunk 2004). A study by Lin and Brown (2020) is the only one that we are aware of that used weights in their model due to unequal probabilities of selection (by race and area) and non-response. While Kapelle and Baxter (2021) examine the association of attrition with wealth and marital dissolution, they did not make any modifications to the analytic model on finding that low wealth was associated with greater attrition. This raises the question of whether the sample design or non-response have an impact on statistical inference and conclusions reached from the estimated model. Are certain groups oversampled or over-represented in the sample due to the sample design, interviewing rules, following rules, or non-response? From attrition analyses, it has been shown that moving house, renting, or being separated or divorced is associated with a higher probability of attrition (Watson & Wooden 2009). Also, Watson (2022) shows that the composition of the sample can change over time due to inclusion of new sample members, such as new partners and that some of these individuals are followed when they leave a household (for example, if they have a child with a continuing sample member). Do the results change in any appreciable way when these differences are taken into account?

In this paper, Australian data from the HILDA Survey, a nationwide household panel study that began in 2001, is used to examine changes in income and wealth for four different marriage dissolution stages for men and women (DSS & Melbourne Institute 2021; Summerfield et al. 2021). Fixed effects models are used to analyse the data. Further, the robustness of the results from the estimated models to different aspects of the sample design and non-response is examined.



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### 3. The Australian Context

The crude marriage rate in Australia in 2019 was 4.5 marriages per 1000 people (Australian Bureau of Statistics 2020). This is a decline of 25% over the past two decades from a rate of 6.0 in 1999. Over the same period, the crude divorce rate fell from 2.8 to 1.9 divorce per 1000 people. For couples that divorce, the median duration from marriage to separation is 8.5 years and divorce typically occurs 3.7 years after that. Just under half of divorces involve a child under 18 (Australian Bureau of Statistics 2018). Australia's marriage and divorce rate ranks in the middle of other OECD countries (OECD Unknown, Chart SF3.1.A and SF3.1.C).

In Australia, a divorce can generally only occur after the couple has separated for 12 months. A separate process to divide the couple's property runs alongside the divorce process. This property settlement can be finalised before the divorce occurs or within 12 months following the divorce. Property is not necessarily split 50:50. The actual split depends on the contributions made by both parties (financial and non-financial) and future needs. Using data from the Australian Divorce Transition Project conducted in 1997 with people who divorced after January 1988, Sheehan (2002) found that, irrespective of the level of wealth, women receive about two-thirds of the couple's domestic assets (house and contents) and around one quarter of the non-domestic assets (such as superannuation, businesses and farms, other property investments or shares). Non-financial contributions to non-domestic assets tended to be undervalued and future needs of the former spouse were generally overlooked (though the needs of dependent children were taken into account). Following changes in 2001 to family laws to allow superannuation to be shared between parties on divorce, a new study (the Superannuation and Divorce Survey) was undertaken. The survey showed that 80% of separating couples divided superannuation or took it into account when dividing other property post-reform compared to 46% of couples pre-reform in the 1990s (Sheehan et al. 2008).



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## 4. Data

The HILDA Survey is a household panel study in which all household members aged 15 and over are interviewed annually (DSS & Melbourne Institute 2021; Summerfield et al. 2021). The sample has a multi-stage clustered design with households clustered within small geographical areas to allow for face-to-face interviewing. The household response rate in wave 1 was 66%, resulting in 7,682 responding households containing 19,914 individuals. These individuals, termed Continuing Sample Members (CSMs), form the basis of the sample that is followed and interviewed over time. Other people who subsequently join the household of these CSMs are temporarily added to the sample. Babies born to a CSM, the other parent of these babies and recent immigrants are converted to CSMs. A general refreshment sample was added to the original sample in 2011, adding a further 2,153 responding households and 5,462 individuals to the sample. The initial household response rate for this refreshment sample was 69%. Re-interview rates (calculated as the percentage of respondents interviewed in one wave that are re-interviewed in the next, excluding those who have died, moved abroad, or are temporary sample members leaving the household of a CSM) are high in both samples. These rates rise from 87% in wave 2 to 96% or higher from wave 9 onwards for the main sample. For the refreshment sample, the re-interview rates rise from 92% in wave 12 to 95% or higher for waves 15 to 19 and was 94% in wave 20 (in 2020).

In this paper, data from all available waves (waves 1 to 20) is used to examine the marital dissolution process but then the sample is restricted to focus on the first 19 waves for the income data (as wave 20 is reserved for use in one of the model modifications examined below). For the wealth models, the sample is restricted to the five years the wealth module has been included which is every four years from 2002.



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## 5. Methods

### 5.1 Income

The income module is asked every year in the Person Questionnaire. This module covers financial year income from wages and salaries, business income, investment income, private pensions, private transfers, Australian government public transfers, other regular public payments and foreign pensions.

Two measures of income are used. The first measure is equivalised household income, which is the total household income divided by an equivalising factor based on the number of adults and children in the household. The OECD factor is used which counts 1 for the first adult in the household, 0.5 for each subsequent adult and 0.3 for each child. This measure assumes that there are economies of scale when people live together and adults and children have different needs. The second measure of income is total personal income.

A number of adjustments are made to the income variables. The variables are first converted to real 2001 values using the Consumer Price Index (Australian Bureau of Statistics 2021). Second, the variables are then winzorised at the top 1%. That is, the cases in the top 1% of the distribution are set to the value of the 99<sup>th</sup> percentile. And third, the variables are transformed using the log transformation which helps to normalise the data. Individual observations with zero or negative income are excluded from the analyses.

### 5.2 Wealth

The wealth module is spread across the Household Questionnaire and the Person Questionnaire. One person in the household provides information on behalf of the household regarding housing assets and debts (the home and other property), business assets and debts, collectibles, vehicles, cash investments, equity investments (shares), trust funds, cash-in value of life insurance policies, children's bank accounts, and overdue household bills. Each person aged 15 and over is subsequently asked about bank accounts



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(own and joint accounts), superannuation, unpaid credit card debt (own and joint cards), higher education debt (relating to the Higher Education Contribution Scheme), and other personal debt.

While it would be preferable to directly isolate the individual's net worth, as can be done with the SOEP data (Kapelle & Baxter 2021), the individual's share of net worth in the HILDA Survey data needs to be estimated. One measure, which makes few assumptions but only incorporates 82% of the household's net worth, is to add the individual's share of housing wealth (collected in the Household Questionnaire and assumed to be shared equally among co-owners in the household) to the individual's financial wealth collected in the Person Questionnaire.

The issue with this measure of wealth is that there are likely gendered differences in the split of other assets and debts collected at the household level that could be relevant to understanding the change in wealth with a marriage dissolution. One of the larger components is net business wealth which is reported by a relatively small number of households (16% of the households included in this analysis) but can contribute significantly to the household's wealth for those that do have it. Using the individual wealth data from the SOEP, Grabka et al. (2013) found that, in Germany at least, business assets strongly contribute to the wealth gap within couples, with men holding on average nearly eight times more business assets than women.

The preferred measure of wealth (termed 'share of net wealth') aims to address this issue. Members of a couple are assigned half of their combined holdings in property wealth, personal assets and 'other wealth' and those not part of a couple are assigned the sum of these components. Other wealth, which includes all components collected at the household level apart from property wealth, is allocated to members in the household according to which of the following six categories they fall into first:

- i) single adult households are assigned all of the other wealth reported at the household level;



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- ii) other wealth is divided between the homeowners in the household;
  - iii) half of other wealth is allocated to each member in the couple in households which do not have another person in the household aged 30 or over (such as an adult child or other related or unrelated person);
  - iv) other wealth is allocated to the lone parent in households which do not have another person in the household aged 30 or over; and
  - v) in group households or other households with related individuals, other wealth is shared equally between adult household members.

This approach assumes that people aged less than 30 have accumulated minimal other wealth and that home ownership is strongly indicative of the accumulation of other wealth. There are 262 observations not assigned a value for other wealth and these are dropped from the analysis (this amounts to 0.8% of the observations that otherwise would be included in the analyses as described further below).

The same three adjustments made to the income variables are made to the wealth variable. It is converted to real 2001 values, winzorised at the top 1% and transformed by taking the natural log of the variable. Individuals with zero or negative wealth are excluded from the analyses.

### *5.3 Marriage Dissolution*

Four stages of marriage dissolution for an individual's first marriage are examined:

1. Married and at least 4 years prior to separation. This includes couples that have not separated, have separated but reunited with their spouse, and those that separate four or more years later.
2. Married and between 1 to 3 years prior to separation. It has been shown that individuals may make some financial preparations in the lead up to separation (Finke & Pierce 2009; Pericoli &



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Ventura 2012) or a worsening of a financial situation can precipitate a separation for some couples (Braver & Lamb 2013).

3. Separated / divorced and not repartnered. In Australia, the minimum separation period is 12 months before divorce papers can be filed. The property settlement process is a separate legal process that runs alongside the divorce process. Some people separate for a long time before they file for divorce and some may not file for divorce at all.
4. Repartnered. The presence of a new partner (either de-facto or through marriage) can alter the financial situation of the household. While repartnering is not typically defined as part of the marital dissolution process, repartnering through marriage, at least, requires that a divorce has occurred previously. Therefore, repartnering may be reasonably defined as the final stage in the dissolution of a previous marriage. Previous studies also indicate that repartnering has important consequences for income and wealth levels (de Vaus et al. 2017; Lin & Brown 2020).

Note that in this sample, people are treated as separated even if they report still living with their ex-partner. This is because there are certain rules in Australia about ex-partners living under the same roof where this time counts towards the 12-month separation period if suitable documentation can be provided for that period.

After restricting the sample to people who are responding in at least two years of the survey and with non-missing covariates, there are 135,250 observations on 12,479 individuals in their first marriage that can be included in the income model. There are 5,064 men and 5,269 women who are continuously married and 1,045 men and 1,101 women who are observed transitioning at least one step from married to separated to divorced. Of the men who separate or divorce, 66% repartner within the observed window and of the women who separate or divorce, 55% repartner. These numbers exclude 114 individuals (906 observations) who were in their first marriage but were missing one or more of the transition dates which





could not be inferred from their observed marital history or relevant partner information. The number of observations for each marital dissolution category is provided in Table 1 with the first category divided into people who are continuously married and those who later separate.

**Table 1. Number of person-year observations across categories of marital dissolution**

	Equivalised household income	Personal income	Share of net household wealth
<b>MEN</b>			
Continuously married	53,448	52,933	12,303
Married and more than 3 years prior to separation (for those who later separate)	2,327	2,303	565
1-3 years prior to separation	2,372	2,350	479
Separated / divorced and not repartnered	4,101	4,083	904
Separated / divorced and repartnered	3,626	3,592	832
Total	65,874	65,261	15,083
<b>WOMEN</b>			
Continuously married	55,379	53,798	12,699
Married and more than 3 years prior to separation (for those who later separate)	2,370	2,319	560
1-3 years prior to separation	2,513	2,468	509
Separated / divorced and not repartnered	5,768	5,751	1,248
Separated / divorced and repartnered	3,210	3,151	709
Total	69,240	67,487	15,725

For the wealth model, after restricting the sample to people responding in at least two wealth years and with non-missing covariates, there are 31,070 observations on 9,175 individuals in their first marriage that can be included. There are 3,642 men and 3,842 women who are continuously married and 814 men and 877 women who are observed transitioning at least one step from married to separated to divorced. The numbers for each marital dissolution category are provided in Table 1.

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The cross-sectionally weighted mean of the equivalised household income, personal income and share of net wealth variables and the log transformed variables for men and women by the various marital dissolution categories is provided in Table A1 in the Appendix.

#### *5.4 Other Covariates*

Controls are included in the model for age, duration of the marriage, whether employed or not, the presence of dependent children, interactions of the level of education with these four variables, wave indicator variables, and income / wealth imputation flags. The duration of marriage variable is set to zero when the individual is separated or divorced from their first marriage. There were 30 individuals (167 observations) that were excluded from the model as they were missing the duration of marriage. The average duration of marriage for those that separate is 12.9 years. The marriage duration variable is centred at this value. Dependent children are children under 15 and children aged 15-24 who are studying, not working and living at home with their parents. The education variable is an indicator of whether the individual graduated from a university bachelor degree (or higher).

In the wealth model, the most important wave dummy is for wave 2 when the wealth questions were a little different from the later waves as information on overdue household bills were not included. Also, from wave 6 onwards, the 'other personal debt' question was split into six separate components: car loans; hire-purchase loans or agreements; investment loans; other personal loans from financial institutions; loans from other lenders; and loans from friends or relatives.

The imputation flags (which indicate whether the income or wealth variable being modelled has been imputed) controls for the situation in which the amounts imputed are different in some way to the reported values.

### 5.5 Model

A fixed effects regression model is fitted to each income and wealth variable. Such models control for time-invariant unobserved variables, as well as correlations between time-invariant predictors and time-varying predictors. An example of a time-invariant unobserved variable that could be relevant here is whether the couple's parents experienced divorce (Keith & Finlay 1988). Compared to a random effects model, the fixed effects model is less prone to bias but this comes at the expense of greater sampling variability (Allison 2009). The fixed effects method uses the within-individual variation in the dependent variable and the covariates over time. The model fitted to the transformed income or wealth variable  $\tilde{y}$  is

$$\tilde{y}_{it} - \bar{\tilde{y}}_i = (\mathbf{x}_{it} - \bar{\mathbf{x}}_i)' \boldsymbol{\beta} + (\varepsilon_{it} - \bar{\varepsilon}_i)$$

where  $\mathbf{x}_{it}$  is a vector of covariates for individual  $i$  ( $i=1\dots N$ ) at time  $t$  as described earlier (where  $t=1\dots 19$  for the income variable as this is observed every year or  $1\dots 5$  for the five wealth years observed). Separate models are fitted to the data for men and women.

The percentage change in  $y$  associated with a change in an indicator covariate  $x$  from 0 to 1 can be approximated by

$$\hat{p} \approx (\exp(\hat{\beta}) - 1) \times 100$$

when  $y$  is large (Wooldridge 2016, p.675).

### 5.6 Model Adjustments for Sample Design and Non-response

To examine the robustness of model parameter estimates to sample design and non-response issues, the model is modified in five different ways:

1. Add a covariate for next wave attrition. This is a strategy that has been adopted by some longitudinal data users to control for the effects of attrition (for example, Bubonya et al. 2017;



Mooi-Reci & Wooden 2017). It requires one extra wave to be available (in our case, wave 20) to calculate the flag for whether the individual was a respondent or not in the next wave.

2. Apply the balanced panel weight. The model is weighted by the longitudinal balanced panel weight, which requires individuals in the income model to be enumerated in waves 1 to 19 or every wave up until they are out of scope (by moving overseas, dying, or no longer living with a CSM) and requires individuals in the wealth model to be enumerated in wave 2 and every subsequent relevant wealth year. This restricts the sample to people who were observed every relevant year.
3. Apply a revised (combined) balanced panel weight. A new longitudinal balanced panel weight used in the income model is calculated from 18 longitudinal balanced panel weights that relate to progressive subsets of years. That is, for people observed in their first marriage in wave 1, the longitudinal balanced panel weight above (i.e., for people enumerated in wave 1 and every subsequent relevant wave) is used. For people whose first marriage started in wave 2, the weight used is for people enumerated in wave 2 and every subsequent relevant wave, and so on. That is, non-response in waves before they were married is immaterial. The new longitudinal balanced panel weight used in the wealth model is calculated in a similar fashion from the four longitudinal balanced panel weights that relate to progressive subsets of wealth years. Importantly, longitudinal balanced panel weights which span years covering waves 11 (i.e., 2011) onwards will enable individuals from the topup sample (which started in 2011) to be included in the model. This combined weight seeks to make the most of the observations included in the analysis while still applying a longitudinal balanced panel weight.
4. Add the cross-section weight as a covariate. One way to adjust a model for the differential probabilities of selection and response is to include in the model all of the variables used to select the sample or are associated with response (Pfeffermann 2011). This would be a large

quantity of variables, some of which are not available to data users. An alternative is to use the weight as a covariate (Pfeffermann 2011). Here the cross-sectional weight is used rather than a balanced panel weight as the balanced panel weight is constant for each individual and would be dropped out of a fixed effects model. The cross-sectional weight will allow for sample design differences (i.e., the selection of the original sample and the application of the following rules) to be accounted for. It is not perfect as further restrictions on the cases included in the model have been made which require individuals to be observed in at least two waves. Nevertheless, it will provide some insights as to whether the results are sensitive to this type of weight.

5. Restrict the sample to original sample members (OSMs). The analysis of the composition of the sample due to the following rules presented in Watson (2022) highlights that including the other members who join the household into the sample changes the composition of the sample from that selected in the initial wave. Some of these changes will be temporary (i.e., the new sample member is not followed when they leave the household of a continuing sample member) and some will be permanent (i.e., the new sample member is converted to a continuing sample member and is followed if they leave the household). To check if the analysis is sensitive to these sorts of changes in the panel composition, the sample is restricted to only the OSMs (i.e., those in the initial wave of the main sample and those in the first wave of the refreshment sample introduced in wave 11).

## 6. Results

### *6.1 Results for the Original Model*

The coefficients and model fit statistics for the income and wealth models are presented in the 'original model' columns of Table A2 to A4 in the Appendix. Figure 1 to 3 report graphical presentations of the key coefficients in the models for graduate and non-graduate men and women for each income and wealth



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variable. Provided next to each value in the figures is the percentage change in the mean-adjusted income or wealth associated with each marriage dissolution stage.

Figure 1 shows that in the three years prior to separation, the equivalised household income for women remains unchanged compared to earlier in the marriage, then following separation there is a sizeable drop in equivalised household income for women of around 20%. This drop in equivalised household income is recovered when women repartner. There are no differences between graduate and non-graduate women in their changes in equivalised household income through the marriage dissolution process. For men, there is no difference in their equivalised household income throughout the marital dissolution process.

When just the income of the individual is considered, Figure 2 shows that men experience no change in their personal income but women have substantial changes to their personal income once they separate. Non-graduate women double their income on average during separation, suggesting they may increase their working hours to help make ends meet. Once they repartner, their incomes are on average 53% higher than when in their first marriage, but not as high as during their separated / divorced phase. Graduate women, on the other hand, increase their income during separation and divorce by 60% and reduce this to 41% once they repartner.

Figure 3 shows the coefficients in the model of the share of net wealth by the different marriage dissolution stages for graduate and non-graduate men and women. In the three years prior to separation, there is a reduction of 21% in the share of net wealth for graduate men. This suggests that graduate men tend to spend more or save less during this time in a way that non-graduate men do not. There is also some suggestion of a reduction in the share of net wealth for men at other parts of the marital dissolution process but none are statistically significant. With more years of wealth data (thus increasing the number of person-year observations) it would be possible to test if these suggestive findings prove true. For women, there is a substantial drop of over half in their share of net wealth when separated. This is partially



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recovered for non-graduate women on repartnering but this recovery does not occur for graduate women.

Figure 1. Coefficient for marriage dissolution and repartnering in the model of equivalised household income (ln), by sex and education

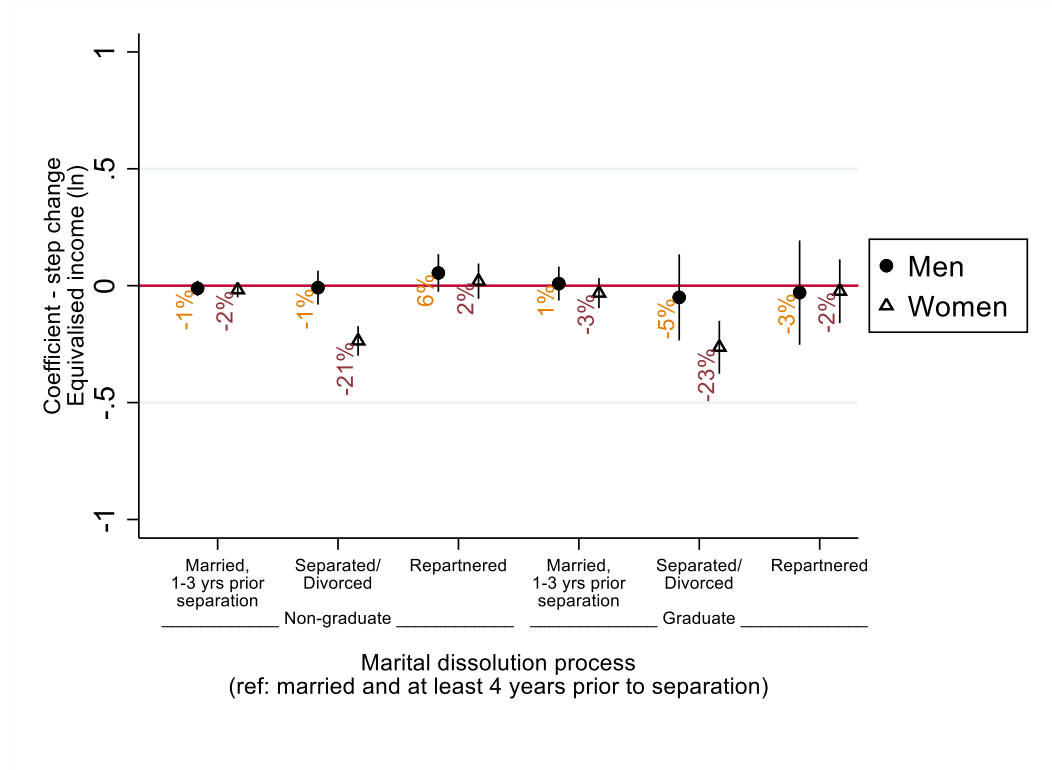


Figure 2. Coefficient for marriage dissolution and repartnering in the model of personal income (ln), by sex and education

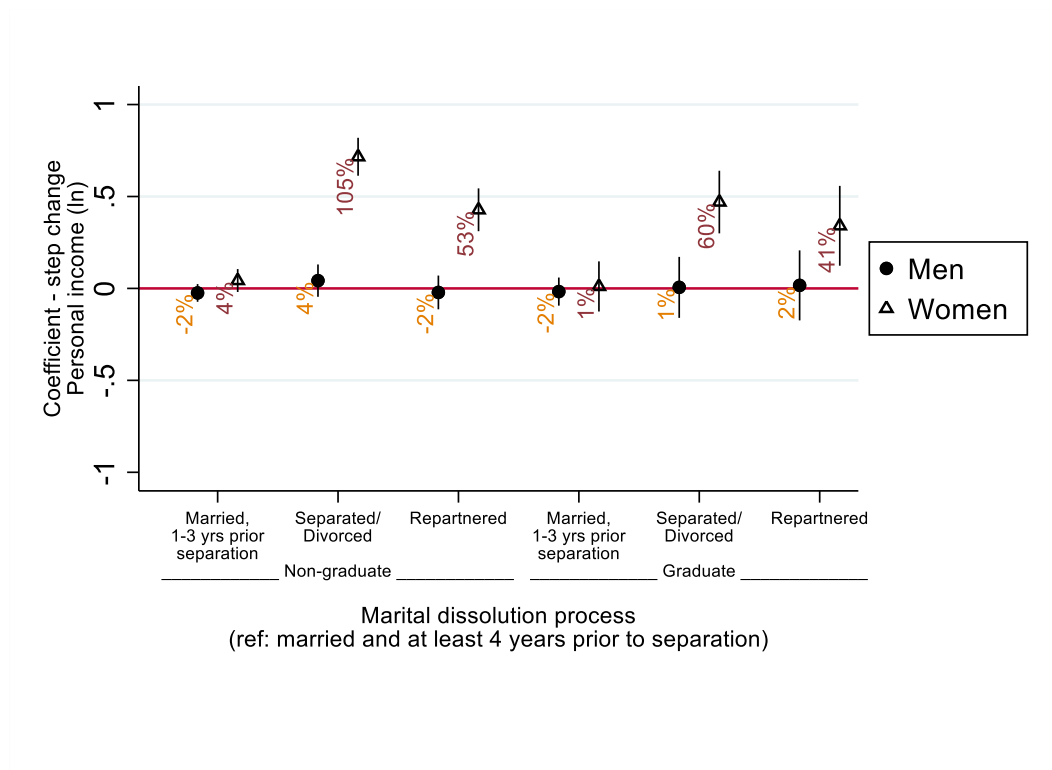
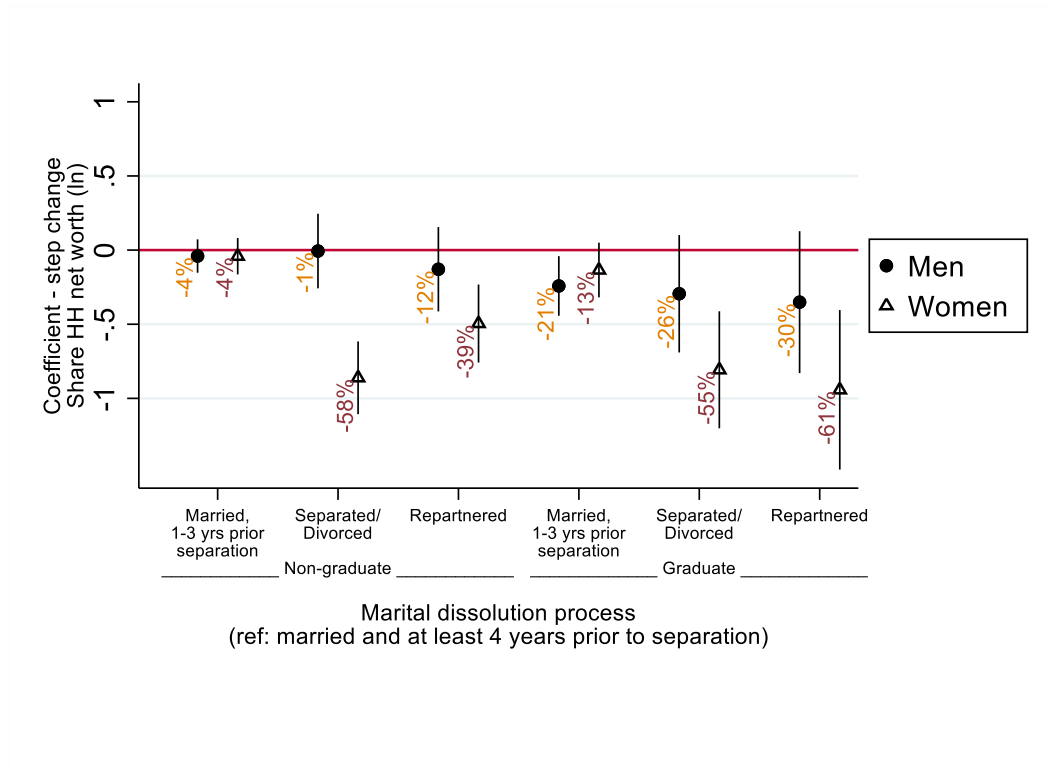




Figure 3. Coefficient for marriage dissolution and repartnering in the model of share of net wealth (ln), by sex and education



### 6.2 Results for Model Adjustments for Sample Design and Non-response

The next series of analyses explore the robustness of the estimated model coefficients to non-response and sample design issues (using approaches 1-5 listed earlier). Figures 4 and 5 show the coefficients for the marriage dissolution stages for men and women respectively in the model of equivalised household income. Similarly to the original models, these results are divided by non-graduate and graduate individuals. Figures 6 and 7 show the results for personal income and Figures 8 and 9 show the results for the share of net wealth.

Figure 4. Coefficient for marriage dissolution and repartnering in model variants of equivalised household income (ln) for men, by education

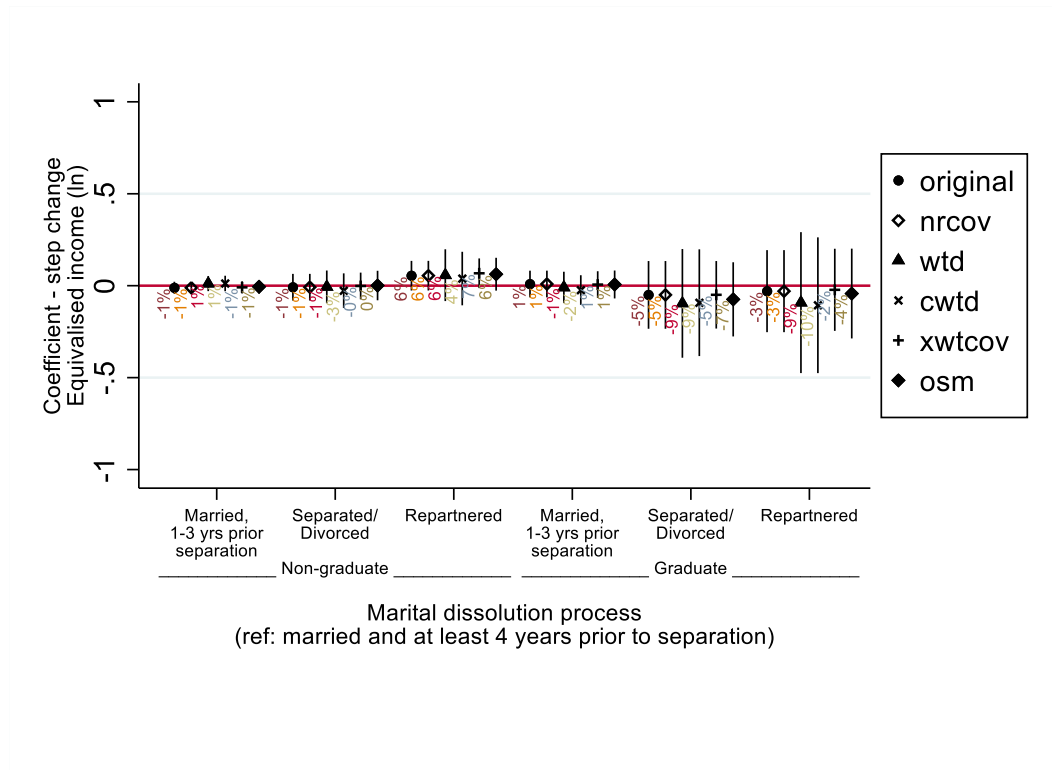


Figure 5. Coefficient for marriage dissolution and repartnering in model variants of equivalised household income (ln) for women, by education

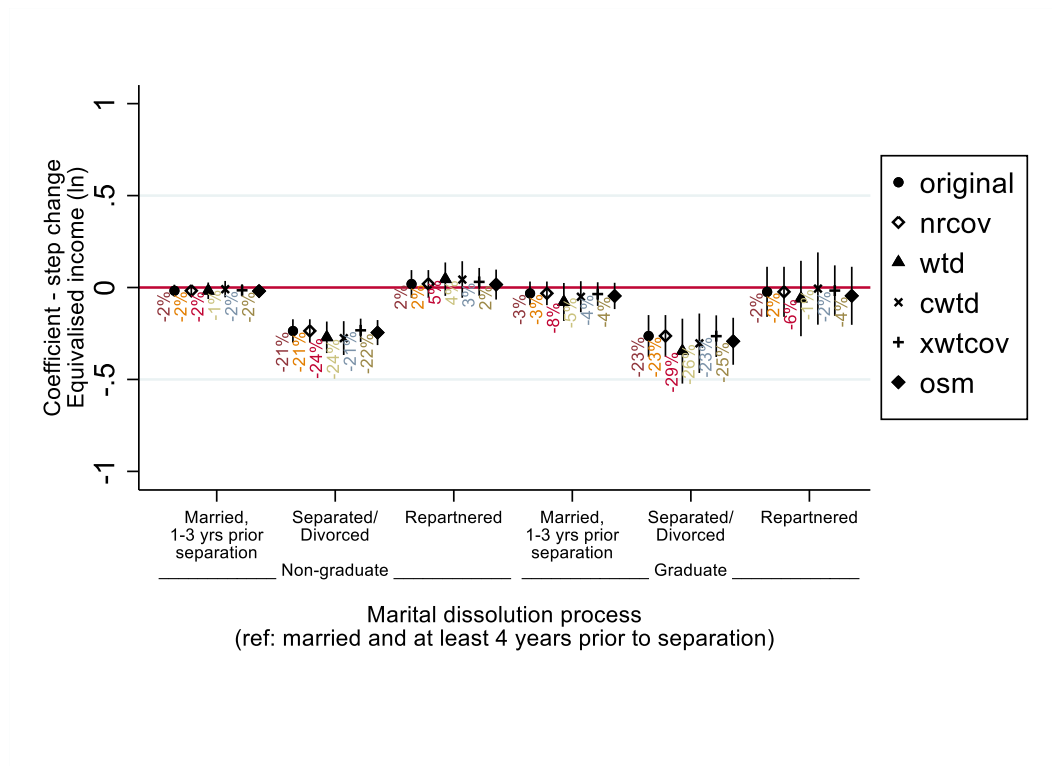


Figure 6. Coefficient for marriage dissolution and repartnering in the model variants of personal income (ln) for men, by education

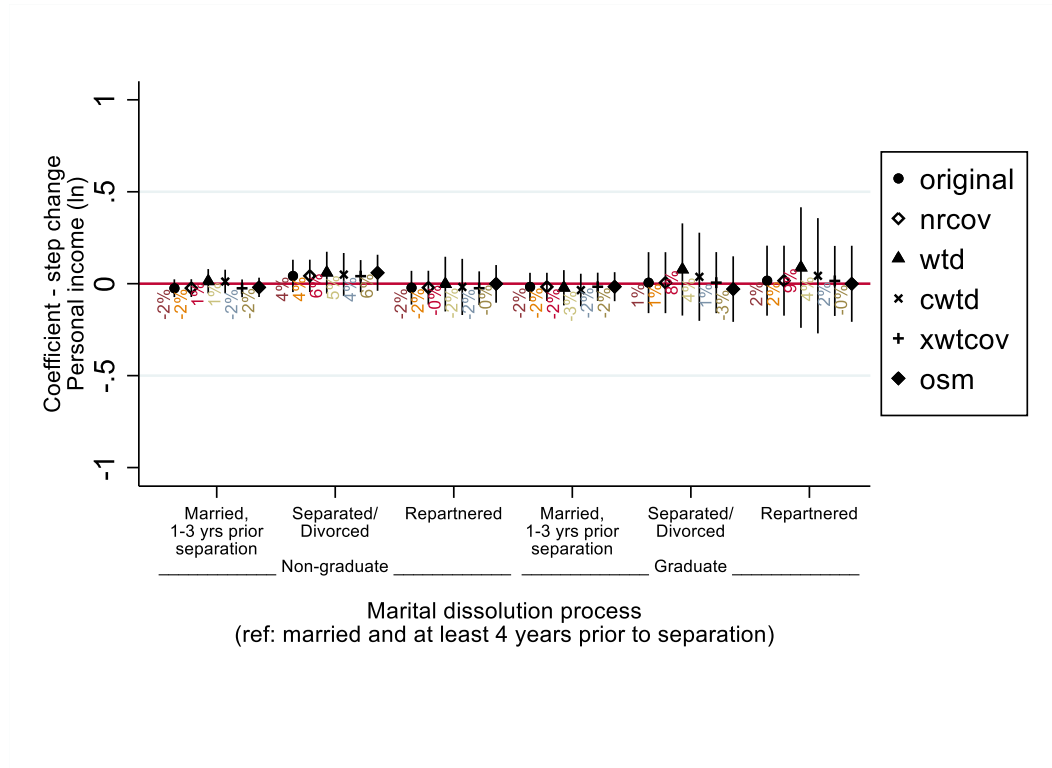


Figure 7. Coefficient for marriage dissolution and repartnering in the model variants of personal income (ln) for women, by education

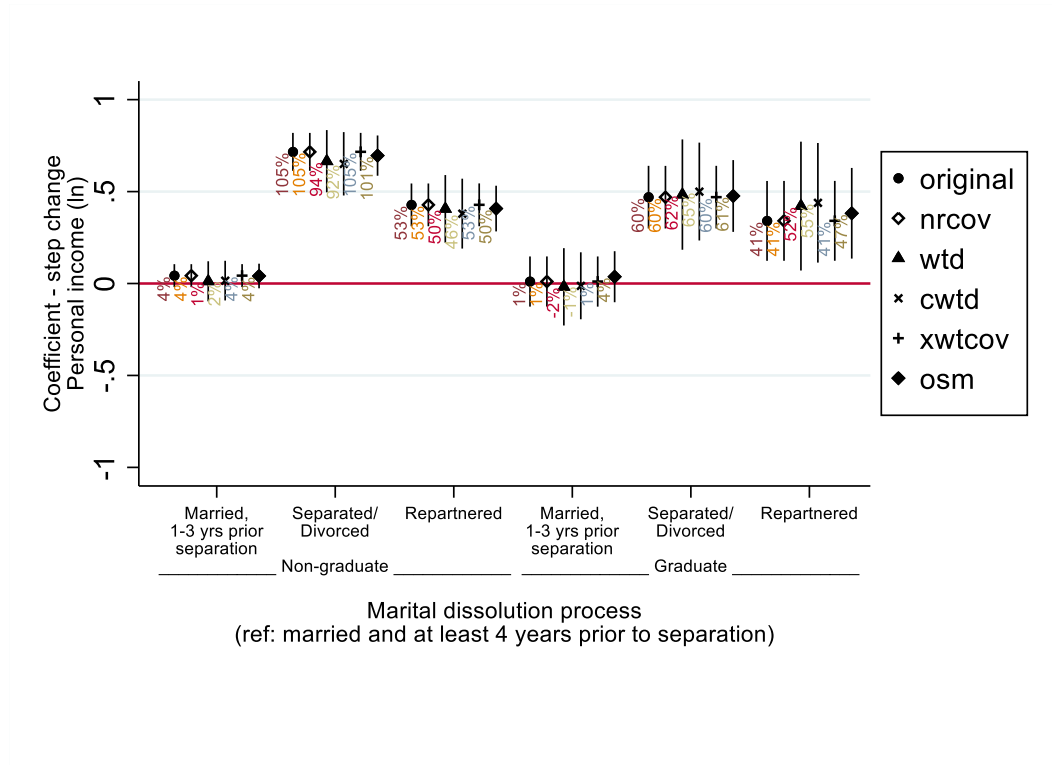


Figure 8. Coefficient for marriage dissolution and repartnering in the model variants of share of net wealth (ln) for men, by education

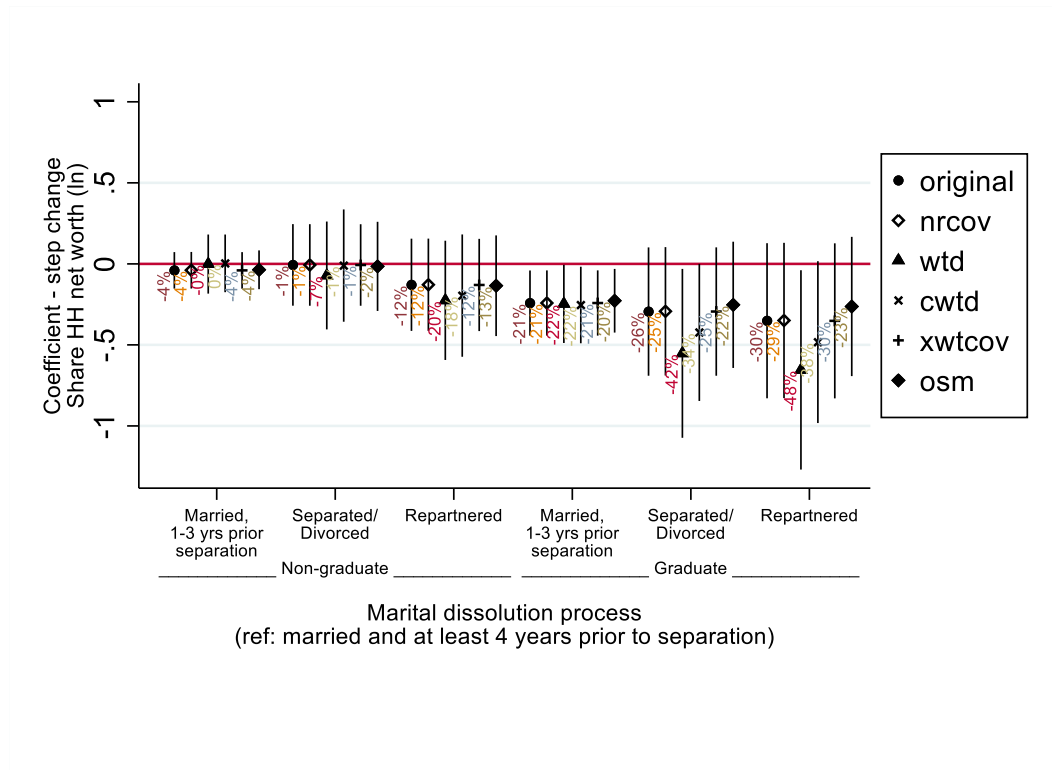
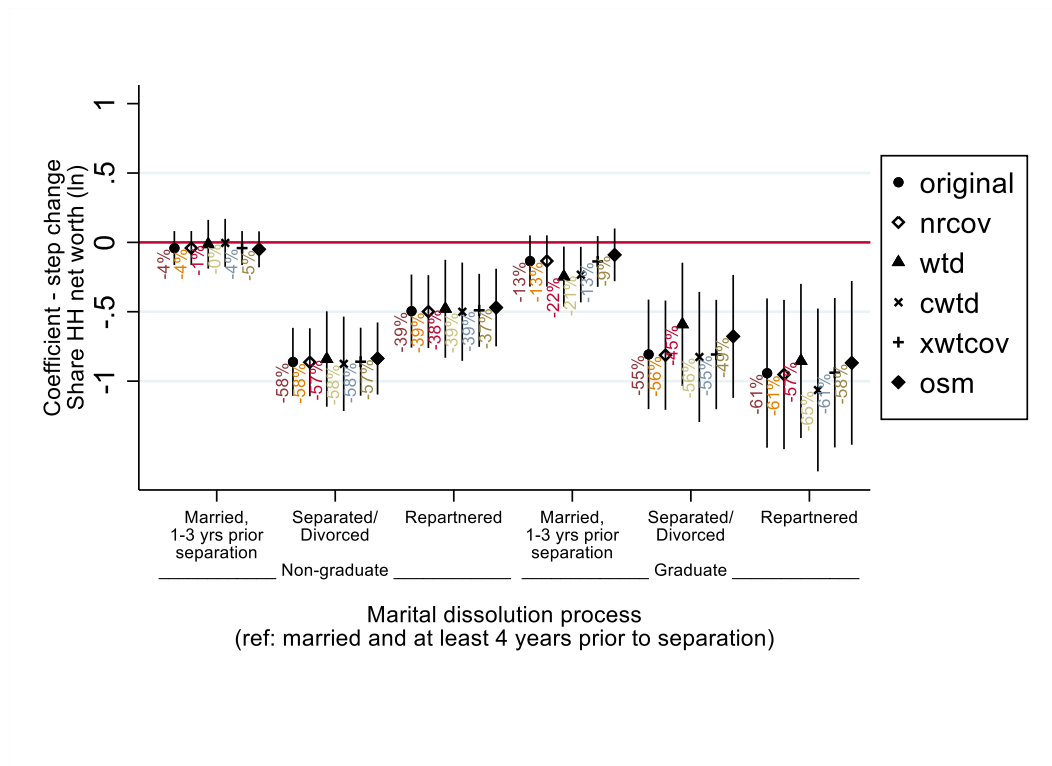


Figure 9. Coefficient for marriage dissolution and repartnering in the model variants of share of net wealth (ln) for women, by education





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The first model variation (“nrcov”) adds an indicator of whether the individual does not respond in the next wave. The coefficient for this covariate is very small and negative. It is significantly different from zero in several of the models fitted (for personal income of women at the 10% level and for the share of net wealth of women at the 5% level). A significant negative coefficient indicates that people not enumerated in the next wave have lower income and wealth amounts. The inclusion of this variable in the model helps to adjust for this difference but the impact on the coefficients for the marital dissolution variables is very minimal, changing the significant coefficients by 0.9% or less. This suggests that even though future non-response has a small impact on some income and wealth variables, this does not materially affect the marital dissolution coefficients.

The second model variant (“wtd”) weights the observations in each model by the balanced panel weight. This reduces the sample size for the income models by 43% for men and 42% for women due to non-response and the exclusion of new respondents (especially in the 2011 refreshment sample). For the wealth model, the balanced panel weight restricts the original sample size by 30% for males and 29% for females. The standard errors for the estimates from the income and wealth models increase generally by between 6% and 83%. Compared to the original model, the overall findings from the income models are unchanged when weights are applied (see Figures 4 to 7). However, greater changes are observed in the wealth model. For some coefficients, the estimates in the weighted model are different enough that despite a larger standard error, the findings from the model are altered. For example, male graduates in the weighted model of the share of net wealth now have significantly less wealth than their continuously married counterparts during the separation and divorce phase and when repartnered (both significant at the 5% level) whereas in the original model a significant decrease did not occur at these points (see Figure 8). This is also true for female graduates in the three years prior to separation: the weighted model shows a significant drop in wealth prior to separation whereas in the original model this was not statistically



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significant (see Figure 9). These results show that when weighting a model, the overall findings can change in substantive ways and not just by reducing the level of significance of coefficients.

The next model (“cwtdd”) weights the observations in the model by a new balanced panel weight which includes those individuals who are part of a responding household in all relevant years (as per the second model “wtd” above) but also includes individuals who begin their first marriage any time after the first wave (being 2001 in the income models and 2002 in the wealth models) and is part of a responding household in all relevant subsequent waves. This increases the person wave observations in the income models compared to the second model by 15% for males and 14% for females. In the wealth models, it adds 14% more person-wave observations for males and 13% for females. The standard errors for the estimates increase generally by between 7% and 79% compared to the original model. With the inclusion of younger marriages, the coefficient estimates for men tend to be a little closer to zero in the share of net wealth model and those for women tend to be further from zero than when using the balanced panel weight (“wtd”), suggesting that men in younger marriages lose proportionally less wealth through the marriage dissolution process than those in more established marriages and women in younger marriages lose proportionally more. The overall findings from the model using the new balanced panel weight echo those of the earlier weighted model with two small exceptions: the estimates in the model of the share of net wealth for male graduates who separate and for those who subsequently repartner have reduced in size and are no longer statistically significant from zero at the 5% level but are still significantly different from zero at the 10% level. In choosing between the two weighted models, this model that includes the more recent marriages is preferred as it would mirror the sample in the original model if there was no attrition.

The fifth model (“xwtcov”) includes the cross-sectional weight as a covariate in the model. This is a proxy measure of the impact of the sample design and non-response on the composition of the analysis sample. Individuals with a lower chance of being included in the sample or of responding have a higher weight and



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those with a higher chance of being part of the sample or are more likely to respond have a lower weight. The estimated coefficient for this covariate is significantly different from zero (at the 1% level) only for the models of equivalised household income and is insignificant for the other models. This indicates that the sample design and/or response is associated with equivalised household income but not personal income or wealth. Nevertheless, the estimates for marital dissolution are barely changed when controlling for this association in the equivalised household income models.

The last model (“osm”) restricts the sample only to those who were OSMs (i.e., in the first wave of the main sample or topup sample). This removes any partners who subsequently join the sample by moving in with one of these OSMs. If these partners were systematically different in some way, then it would become evident through this model. Post-separation, the non-OSM partners that are followed are those who had a child with an OSM. Non-OSM partners without children are not followed once they separate from an OSM. Restricting the sample to OSMs results in a reduction of 12% of the person year observations for men and 11% for women in the income models compared to the original models. The size of the sample for the wealth models is 10% less for men and 9% less for women. The estimates from the income models are largely unchanged but some changes are seen in the wealth model: both men and women tend to lose less wealth in this model variant. This suggests that including non-OSMs with children biases the estimates of the impact on wealth accumulation downwards. That is, there is potentially greater wealth loss for separating couples with children compared to those without children. This is possibly due to higher legal costs, the need to provide childcare, and the provision of two homes suitable for children.

Overall, these model variants have helped draw out some of the nuances of the sample. Nevertheless, the results are largely robust to the use of weights. While the standard errors are larger when weights are applied, some estimates substantially shifted in the share of net wealth model and became significant. The broad messages remain. The weighted models further show graduate women have a loss to their

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share of net wealth in the three years prior to separation and that the loss of net wealth for graduate men deepens during separation and is sustained after repartnering. The restriction of the sample to OSMs is relevant to avoid overstating the impact of marital dissolution on the share of net wealth.

## 7. Discussion

This paper examined the impact of marital dissolution on income and wealth in Australia and tested how robust these findings are to sample design and non-response issues. Women are affected financially much more than men by the marital dissolution process. The broad messages of this analysis are: i) during separation and divorce women have lower equivalised household incomes than men which is rectified through repartnering; ii) women have substantial increases in personal income during separation and divorce, more so for non-graduate women than graduate women; iii) much of this increase in personal income for women remains after repartnering; iv) women have substantial losses to their share of net wealth during separation and divorce, some of which is rectified for non-graduate women through repartnering; v) men generally experience comparatively little or no impact on their financial situation through the divorce process though graduate men have a loss of their share of net wealth in the three years prior to separation.

Of the two weighted models that were fitted to examine the impact of sample design and non-response issues, the model using the combined balanced panel weights is preferred over the balanced panel weights as it includes marriages of people involved with the study at the start of the panel as well as marriages occurring later in the panel irrespective of any non-response that may have occurred before the marriage. The results for the share of net wealth change somewhat when weighted and not just because covariates lose significance due to larger standard errors. There is a greater loss to graduate men's share of net wealth during separation and divorce and this is sustained during repartnering whereas there was no difference in the unweighted model. There is also a greater loss to graduate women's share





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of net wealth in the three years prior to separation, with the difference now significantly different from zero (at the 5% level) in the weighted model.

There are also some small differences in the wealth results when the sample is restricted to OSMs. This means that partners who join the household of an OSM and have a child with them (i.e., those who are followed in the HILDA sample if they leave the household of an OSM) are excluded from the analysis sample in the same way partners without children are excluded once they separate from the OSM. When the analysis of the share of net wealth is restricted to OSMs, the estimates are a little closer to zero (by up to 7 percentage points) than when the non-OSM partners with children are included. This avoids overestimating the impact of marital dissolution on wealth, albeit at the margin.

The other measures to address sample design or non-response issues, such as adding an indicator for future non-response or the cross-sectional weight in the model, did little to change the estimates.

These analyses show it is important to examine what impact the combined balanced panel weight and restricting the sample to OSMs have on the model results. Where there are differences, it is important to seek to understand the reason for these differences, and potentially make amendments to the original model. In our case, the results of the unweighted income models were similar to those of the weighted income model, but the wealth model results did change when weighted, suggesting that some important variable is missing from the model. We checked if adding interaction terms between the marital dissolution indicators and the presence of dependent children in the household reduced the impact of the weights and the restriction of the sample to OSMs. It helped a little (results not shown) so further work could explore if other variables matter, such as the age of the dependent children, or whether the household own their home. An alternative line of inquiry would be to see if assortative mating by higher education is playing a part in these results, though the sample sizes in some groups may be problematic.

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There are a number of limitations to these analyses. It was not possible to split non-property household wealth collected at the household level without making quite a few assumptions. Nor could households with negative net wealth be included as the log transformation causes these cases to be missing (about 2% of cases). There are also other ways in which the sample design or non-response issues may be taken into account in the model that have not been examined here, such as jointly modelling the non-response mechanism with the marital dissolution model (Carpenter & Plewis 2011; Heckman 1979), multiple imputation (Goldstein 2009; Silverwood et al. 2020), or by sampling known values with replacement according to sampling weights (Feder 2011).

In terms of further work, researchers are encouraged to test the impact of non-response and sample design issues on their analyses as robustness checks. Further work could also develop and assess weights that are specific to OSMs and their descendants without the inclusion of any temporary sample members that may join the panel. Of course, identifying when alternative weights are better is difficult when there is a paucity of alternative longitudinal data sources to compare with, though this is changing with advances made on administrative data linkage.



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## Appendix

Table A1 Summary statistics for (real winzorised) equivalised household, personal income and share of net wealth by marital dissolution stage (weighted)

	Equivalised household income		Personal income		Share of net household wealth	
	\$	ln	\$	ln	\$	ln
	Mean	Mean	Mean	Mean	Mean	Mean
MEN						
Continuously married	36,293	10.3	41,248	10.3	392,069	12.2
Married and more than 3 years prior to separation (where later separate)	33,437	10.3	42,030	10.4	236,840	11.7
1-3 years prior to separation	35,516	10.3	42,484	10.4	283,971	11.7
Separated / divorced and not repartnered	36,368	10.3	37,207	10.3	282,797	11.5
Separated / divorced and repartnered	42,013	10.5	47,106	10.5	272,685	11.9
WOMEN						
Continuously married	36,104	10.3	23,806	9.7	398,812	12.2
Married and more than 3 years prior to separation (where later separate)	32,824	10.3	22,900	9.7	256,343	11.8
1-3 years prior to separation	34,332	10.3	25,768	9.8	286,365	11.8
Separated / divorced and not repartnered	29,043	10.1	34,216	10.3	300,407	11.6
Separated / divorced and repartnered	38,606	10.4	31,287	10.1	270,296	11.9



Table A2 Model coefficients for equivalised household income for model variants

Variable	Original model	With attrition indicator	Weighted (balanced panel)	Weighted (combined balanced panel)	With cross-sectional weight covariate	Restricted to original sample members
<b>MEN</b>						
Marriage dissolution (base=Married, >3 yrs prior separation)						
Married, 1-3 yrs prior separation	-0.011	-0.011	0.011	0.012	-0.009	-0.006
Separated / divorced	-0.008	-0.008	-0.006	-0.027	-0.002	0.001
Repartnered	0.063*	0.063*	0.064	0.066	0.069**	0.062*
Graduate x marriage dissolution (base=graduate, married, >3 yrs prior separation)						
Graduate, married, 1-3 yrs prior separation	0.020	0.020	-0.021	-0.036	0.015	0.012
Graduate, separated / divorced	-0.042	-0.042	-0.090	-0.066	-0.048	-0.075
Graduate, repartnered	-0.042	-0.042	-0.059	-0.080	-0.042	-0.030
Not enumerated next wave		-0.009				
Cross-sectional weight/10 <sup>3</sup>					0.035**	
Number of observations	65,874	65,874	37,471	42,811	65,874	58,252
Log-likelihood	-24,201	-24,201	-14,671	-16,564	-24,154	-22,635
<b>WOMEN</b>						
Marriage dissolution (base=Married, >3 yrs prior separation)						
Married, 1-3 yrs prior separation	-0.017	-0.017	-0.018	-0.009	-0.015	-0.019
Separated / divorced	-0.236**	-0.236**	-0.271**	-0.275**	-0.233**	-0.245**
Repartnered	0.256**	0.256**	0.316**	0.319**	0.263**	0.261**
Graduate x marriage dissolution (base=graduate, married, >3 yrs prior separation)						
Graduate, married, 1-3 yrs prior separation	-0.014	-0.014	-0.061	-0.041	-0.020	-0.027
Graduate, separated / divorced	-0.027	-0.027	-0.075	-0.028	-0.032	-0.047
Graduate, repartnered	-0.016	-0.016	-0.030	-0.021	-0.016	-0.014
Not enumerated next wave		-0.010				
Cross-sectional weight/10 <sup>3</sup>					0.040**	
Number of observations	69,240	69,240	39,964	45,335	69,240	61,501
Log-likelihood	-24,601	-24,600	-15,336	-16,826	-24,530	-23,308

Significance: \*\* p<0.01, \* p<0.05, † p<0.1. Model also controls for age (cubic), duration married, employment, presence of dependent children, interaction of graduate and these four covariates, indicator of imputed wealth and year.



Table A3 Model coefficients for personal income for model variants

Variable	Original model	With attrition indicator	Weighted (balanced panel)	Weighted (combined balanced panel)	With cross-sectional weight covariate	Restricted to original sample members
<b>MEN</b>						
Marriage dissolution (base=Married, >3 yrs prior separation)						
Married, 1-3 yrs prior separation	-0.025	-0.024	0.013	0.012	-0.025	-0.020
Separated / divorced	0.042	0.043	0.060	0.050	0.041	0.059
Repartnered	-0.064*	-0.064*	-0.062	-0.068	-0.065*	-0.060*
Graduate x marriage dissolution (base=graduate, married, >3 yrs prior separation)						
Graduate, married, 1-3 yrs prior separation	0.007	0.007	-0.035	-0.047	0.008	0.004
Graduate, separated / divorced	-0.036	-0.037	0.017	-0.012	-0.035	-0.089
Graduate, repartnered	0.075	0.075	0.073	0.073	0.075	0.089 <sup>†</sup>
Not enumerated next wave		-0.018				
Cross-sectional weight/10 <sup>3</sup>					0.008	
Number of observations	65,211	65,211	37,171	42,478	65,211	57,698
Log-likelihood	-47,457	-47,456	-27,173	-31,230	-47,456	-42,913
<b>WOMEN</b>						
Marriage dissolution (base=Married, >3 yrs prior separation)						
Married, 1-3 yrs prior separation	0.043	0.043	0.012	0.016	0.043	0.041
Separated / divorced	0.716**	0.716**	0.665**	0.651**	0.716**	0.696**
Repartnered	-0.288**	-0.288**	-0.259**	-0.271**	-0.288**	-0.288**
Graduate x marriage dissolution (base=graduate, married, >3 yrs prior separation)						
Graduate, married, 1-3 yrs prior separation	-0.032	-0.032	-0.030	-0.028	-0.032	-0.004
Graduate, separated / divorced	-0.246*	-0.246*	-0.182	-0.151	-0.246*	-0.220 <sup>†</sup>
Graduate, repartnered	0.159*	0.160*	0.197*	0.210*	0.159*	0.194**
Not enumerated next wave		-0.031 <sup>†</sup>				
Cross-sectional weight/10 <sup>3</sup>					0.001	
Number of observations	67,487	67,487	39,060	44,296	67,487	60,035
Log-likelihood	-65,919	-65,917	-38,640	-44,014	-65,919	-58,238

Significance: \*\* p<0.01, \* p<0.05, <sup>†</sup> p<0.1. Model also controls for age (cubic), duration married, employment, presence of dependent children, interaction of graduate and these four covariates, indicator of imputed wealth and year.





Table A4 Model coefficients for share net wealth for model variants

Variable	Original model	With attrition indicator	Weighted (balanced panel)	Weighted (combined balanced panel)	With cross-sectional weight covariate	Restricted to original sample members
<b>MEN</b>						
Marriage dissolution (base=Married, >3 yrs prior separation)						
Married, 1-3 yrs prior separation	-0.040	-0.039	-0.001	0.003	-0.040	-0.037
Separated / divorced	-0.006	-0.007	-0.072	-0.011	-0.007	-0.015
Repartnered	-0.123	-0.122	-0.153	-0.185 <sup>†</sup>	-0.123	-0.119
Graduate x marriage dissolution (base=graduate, married, >3 yrs prior separation)						
Graduate, married, 1-3 yrs prior separation	-0.202 <sup>†</sup>	-0.202 <sup>†</sup>	-0.246	-0.257 <sup>†</sup>	-0.201 <sup>†</sup>	-0.191
Graduate, separated / divorced	-0.288	-0.286	-0.481	-0.413	-0.287	-0.237
Graduate, repartnered	0.066	0.065	0.051	0.126	0.066	0.109
Not enumerated next wave		-0.026				
Cross-sectional weight/10 <sup>3</sup>					0.003	
Number of observations	15,024	15,024	10,586	11,623	15,024	13,574
Log-likelihood	-10,146	-10,146	-8,154	-9,198	-10,146	-9,111
<b>WOMEN</b>						
Marriage dissolution (base=Married, >3 yrs prior separation)						
Married, 1-3 yrs prior separation	-0.041	-0.041	-0.014	-0.003	-0.041	-0.050
Separated / divorced	-0.861**	-0.864**	-0.841**	-0.875**	-0.860**	-0.837**
Repartnered	0.366**	0.365**	0.362**	0.376**	0.371**	0.367**
Graduate x marriage dissolution (base=graduate, married, >3 yrs prior separation)						
Graduate, married, 1-3 yrs prior separation	-0.093	-0.093	-0.233	-0.229 <sup>†</sup>	-0.096	-0.040
Graduate, separated / divorced	0.054	0.051	0.250	0.049	0.052	0.159
Graduate, repartnered	-0.501**	-0.504**	-0.626**	-0.614**	-0.502**	-0.558**
Not enumerated next wave		-0.098*				
Cross-sectional weight/10 <sup>3</sup>					0.020	
Number of observations	15,642	15,642	11,109	12,194	15,642	14,196
Log-likelihood	-11,290	-11,284	-9,159	-10,078	-11,288	-10,260

Significance: \*\* p<0.01, \* p<0.05, † p<0.1. Model also controls for age (cubic), duration married, employment, presence of dependent children, interaction of graduate and these four covariates, indicator of imputed wealth and year.