The impact of mortality and union dissolution on the household status of the elderly in Norway

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Abstract
We analyse the household status of elderly men and women in Norway in the future. A new trend is that persons aged 80+ are less likely to live alone in the future, and more often with a partner. The level of mortality, the mortality sex gap, union dissolution at young and intermediate ages, and entry into and exit from institutions for the elderly are important determinants. We use the macro simulation program LIPRO to simulate the household dynamics in Norway to 2032. Data sources are the Survey on Living Conditions (1998 to 2002 panel waves), the census of 2001, and forecasts of births, deaths, and net migration calculated by Statistics Norway.

1. Relevance of future living arrangements of the elderly

The living arrangements of the elderly affect not only their well-being, but also the future demand for public services as those living with a partner tend to utilize certain public services to a lesser degree than those who live by themselves. The effect is especially strong when it comes to nursing home places. Having a spouse or partner who is willing to help with household chores, personal care and nurse in cases of illness, makes it possible to live independently, even when one is incapable of taking proper care of one's needs. Indeed, a number of studies have shown that those elderly who live as part of a couple demand less formal care, such as places at an institution, than those who live on their own (e.g. Grundy and Jital, 2007). Another benefit of living in a union is a possible effect of household economies of scale. A study of nine OECD countries found that women aged 75 and over who lost their spouse had their disposable income reduced by between 13 and 39 per cent mainly due to foregone economies of scale (Casey and Yamada, 2002). Beyond these material benefits, a partner is a source of emotional and practical support and someone to turn to for help and consolation in difficult periods. Among the elderly in particular, the partner is a major source of social contact preventing loneliness, which in turn has beneficial health effects.

At the same time, all of the positive effects mentioned here (more well-being, lower demand for public services and institutional care, economies of scale, social contact and emotional support) are causal factors for the tendency of individuals to start living with a partner, or staying in a partnership.

2. A new household forecast for Norway

A new household forecast for Norway indicates a continuation of trends that have been observed for some decades already: fewer couples with children, more cohabiting couples, and more one-person households. Figure 1 shows an expected increase in the number of private households by one-third, from 2.02 million in 2002 to 2.67 million in 2032. Households that consist of a married couple with one or more children (MAR+) are expected to fall by 21 per cent, while cohabiting couples households, both without (COH0) and with (COH+) children become more important. The strongest growth is seen for one-person households (SIN0). Their numbers increase by 46 per cent in the thirty-year period, from 744,000 to 1.084 million.

The population is expected to increase only moderately, by 21 per cent. Since the number of elderly living in institutional households will remain more or less constant (see below), the average size of private households will fall from 2.2 persons per household in 2002 to 2.0 in 2032.

A new trend is that the elderly are more likely to live with a partner in the future, and less likely to live alone. Figures 2a and 2b show an increase over time in the shares of elderly men and women who live with a spouse. For men in particular, the increase is large: the age group 80+ as a whole will see its share growing from 54 per cent in 2002 to 75 per cent in 2032. An alternative way of looking at Figure 2 is to interpret the increase as a consequence of the age pattern stretching to the right in the course of time. For ages beyond 70 years, curves are shifted over some two to five years towards higher ages.

Most of the changes occur in the first ten years of the projection period. This is explained by the irregularities in the age-sex-household structure of the population in 2002, combined with the constant rates for household formation and dissolution that we applied for the future. (More details on this in Section 3.) The ergodic theorem of stable population theory tells us that the age-sex-household structure will initially follow a wave-like pattern, but eventually become constant.

For women, similar trends have been predicted for other European countries; for men such developments have not been documented earlier. Kalogirou and Murphy (2006) projected that the share of married women aged 75+ will increase by 16 percentage points in nine European countries in the period 2001-2031[1]. For married men the shares are stable (widowers 6 percentage points down due to improved longevity, divorced men 7 percentage points up as a consequence of increased divorce in the past). Liefbroer and Dykstra (2000) predicted a modest increase in the share of Dutch women aged 80+ who live with a partner (8 percentage points up from generation 1911-1920 to 1931-1940). Alders and Manting (1999) projected the share of women 80+ who live with a partner in EU15-countries to increase from 15 per cent in 1995 to 20-33 per cent in 2025. For men the projected trend in this share depended strongly on the assumptions they applied.

Following up on Kalogirou and Murphy (2006), Figure 3 plots observed trends in the shares of elderly men and women with marital status "married". Both sexes show a modest increase since 1977.

The purpose of this paper is to analyse the reasons for the projected increases in the shares of elderly men and women who live with a partner. We focus on possible demographic explanations. Future numbers of persons who live with a partner are the result of current numbers of persons who live with a partner, and of processes of couple formation and dissolution. An important reason why elderly couples see their relationship dissolved, is the death of one of the partners. Hence we include mortality in our analyses,

[1] Note that Kalogirou and Murphy projected the elderly by broken down by marital status, not by living arrangement. For the elderly, however, numbers who have marital status "married" are very close to those who live with a marital spouse. Census data for Norway (November 2001) show that among men (women) aged 80+, 53 per cent (15 per cent) lived with a marital spouse, whereas 57 (17) per cent had marital status "married"; see also Figure 3. We expect that one would find similar small differences for the countries that Kalogirou and Murphy analysed, had the data been available.

in addition to marriage, entry into a consensual union, divorce and separation. A second reason for couple dissolution is that one of the partners moves to an institution. Processes of entry into and exit from institutions for the elderly are also analysed.

The household forecast contains only a few demographic factors at the macro level. Thus there are not many possibilities for a detailed analysis. Our strategy is to perform a series of sensitivity analyses, in order to trace the consequences of changes in a number of components of change for the chances that elderly persons live with their partner. We investigate the following components: mortality, pair formation and dissolution, and entry into and exit from institutional households. Those sensitivity analyses give us the answer to two questions. First, which one among the components mentioned here is the most important one for the elderly's chances to live with a partner? And secondly, how large changes in those components are needed in order to neutralize the increase in the proportion living with a partner?

Some of the sensitivity analyses imply unrealistically strong changes in one or more of the components. Thus a large part of the paper is concerned with counterfactual simulations.

We start in Section 3 with some general information about the household forecast. Section 4 reports the simulations for the jump-off population (4.1), mortality (4.2), pair formation and dissolution (4.3), entry into and exit from institutional households (4.4), and finally a set of simulations in which we combine the components of Sections 4.2 to 4.4. Section 5 summarizes our main conclusions.

3. LIPRO simulations

We used the program LIPRO ("Lifestyle projections") version 4.0 to compute the household forecast for the years 2002-2032, and the sensitivity variants. LIPRO (see http://www.nidi.knaw.nl/en/projects/section2/270101/ and Van Imhoff and Keilman 1991) is based on the methodology of multi-state demography, but includes several extensions to solve the particular problems of household modelling. The forecast updates an earlier one that applied to the years 1990-2020 (Keilman and Brunborg 1995).

LIPRO implements a multi-state demographic book-keeping model that focuses on flows between the states. Or, we have

$$\boldsymbol{V}_{t+1} = P_t.\boldsymbol{V}_t + Q_t.\boldsymbol{I}_t,$$

where $\boldsymbol{V}_t$ is a column vector of the population at time t, broken down by household position (also called living arrangement), age (0-4, 5-9, … 85-89, 90+) and sex; $\boldsymbol{I}_t$ is a column vector of immigrants during the time period (t, $t+1$) with the same format as $\boldsymbol{V}_t$, while P_t and Q_t are square matrices that contain time-dependent rates for births, deaths, and household events, by age, sex and household position. The jump-off time t = 0 corresponds to 1 January 2002. The number and types of household positions that we selected are a compromise between conflicting arguments. On the one hand, we want to have many household positions, in order to provide the user of the forecast with detailed results. But the available data restrict the possibilities one has to a considerable extent. We have used the following nine household positions for individuals:

1. CHLD – dependent child living with one or both parents.
2. COH0 – living in a consensual union without dependent children.
3. COH+ –living in a consensual union with dependent children.
4. MAR0 – living with a spouse without dependent children.
5. MAR+ – living with a spouse and dependent children.
6. SIN0 – person living in a one-person household.
7. SIN+ – single mother or father.
8. OTHR – living in a private household, but not in any of the positions 1-7.
9. INST – living in an institution for the elderly.

“Children” are defined as persons under 25 years of age who live in the household of one or both parents. A young adult aged 25 or over who still lives with his or her parent(s) belongs to the category “other”. The latter category also includes persons who live in a multi-person household but who have no relationship (parent-child, or partner in consensual or marital union) to the other household members. The category of cohabiting persons includes those who report to have a marriage-like relationship with another person without being married to the partner, but irrespective of partner’s sex. Cohabiting persons can have any marital status. The category of married persons consists of those who are currently married and live together with the spouse. The institutionalized population is restricted to ages 65 and older.

To specify the jump-off population, we used data from the Population and Housing Census of Norway, 3 November 2001.

Restricting ourselves to private households with eight household positions, there are 7 x 8 = 56 candidates for changes of position, but not all are logically possible. For instance, a person cannot change directly from “married, no children” to “cohabiting, with children”. We estimated occurrence-exposure rates for changes of private household position from the Survey of Living Conditions using data from 1997-2002, for ages 16-79. In 1997, sample size was approximately 5000. We deduced household events from changes in reported positions in consecutive interviews.[2] Added over all five calendar years, we obtained 3,645 events of 27 different types, and 22,462 years of exposure. Data on entries into and exits from institutional households are extremely scarce. We have used the entry rates and exit rates employed in the previous household forecast of Keilman and Brunborg (1995).

Birth rates by five-year age-group and household position of the mother were taken from the previous household forecast and adjusted proportionally to match the numbers that Statistics Norway had registered for 2002-2006. *Death rates* by five-year age-group, sex and household position were estimated based on data from the Norwegian population registers. Øystein Kravdal kindly supplied us with deaths and exposure times by marital status, age and sex for the years 1995-99.[3] We applied the death rates of the “currently married” to household positions “cohabiting” or “married”; death rates of the never married to persons with household position “child”, “living alone”, or “other”; and death rates of the divorced to “lone parents”. Since individuals who live in an institution have higher mortality than those who live in private households, death rates for the institutionalized were assumed twice as large as those of the never married (given age and sex).

International migration was specified as net immigration. The level of net immigration for the years 2002-2006 was taken from data available from the population registers. Its distribution by age, sex and household position was borrowed from the previous household forecast. Thus the vector $\boldsymbol{I}_t$ contains absolute numbers.

[2] We discarded information about two or more household events in one calendar year. This occurred rarely. Similarly, due to both left and right censoring, a number of events could not be uniquely classified.
[3] Mortality data by marital status for Norway are not available for more recent years.

In the LIPRO formulation, the units of analysis are individuals, and household statuses are viewed as their characteristics. This opens up the possibility of inconsistency between the attributes (Van Imhoff and Keilman 1991, Van Imhoff 1992). We defined 15 consistency relations for couple dissolution and events experienced by children and by parents, and one each for the total number of births, deaths, and net immigration. LIPRO adjusted the parameter values for household events and external events in such a way that all relationships were fulfilled. We also constrained total numbers of births, deaths, and net immigration to corresponding numbers taken from observed population data for the years 2002-2004, and from the Medium Variant of Statistics Norway's 2005-based population forecast; see http://www.ssb.no/english/subjects/02/03/folkfram_en/.[4] Finally, we constrained the total population living in an institution to 41,000, which is the level observed in the years 2003, 2004, and 2005. Based on the consistent events, LIPRO used bookkeeping equations to update the population by age, sex, and household position.

Apart from adjustments for consistency, parameters for household events were assumed constant over the forecast period, because the possible trends visible in our data were erratic. The simulations obtained this way will be labelled as Benchmark from here onwards.

4. Simulations

4.1 Starting population

We performed a counterfactual simulation in which each population category (defined as a combination of age, sex, and household position) of the jump-off population was given the value of 100 (CHLD up to age 25, INST from age 65 onwards). Numbers of births during each five-year period were set to 200, and we assumed a net migration level of zero.

In the jump-off situation, half of the men and women aged 80 or over were living with a partner. (The remaining 50 per cent were either in position SIN0, SIN+, OTHR, or INST.) For women this share dropped quickly to 13 per cent in 2017, and 8 per cent in 2032. For men the decrease was much slower: 34 per cent in 2017, and 20 per cent in 2032. Hence, instead of an increase by 12 percentage points for women and of 31 percentage points for men in the Benchmark situation, the "rectangular" jump-off population results in decreases by 42 and 30 percentage points,

[4] Statistics Norway published a new population forecast in May 2008, which we were unable to include in the present analyses.

respectively. Based on this result, we conclude that much of the increase in the share of the 80+ who live with a partner is already embodied in the observed population as of 2002.

This conclusion is confirmed by Table 1, which applies to the Benchmark projection.

Table 1 Share of elderly men and women who live with a partner, Benchmark

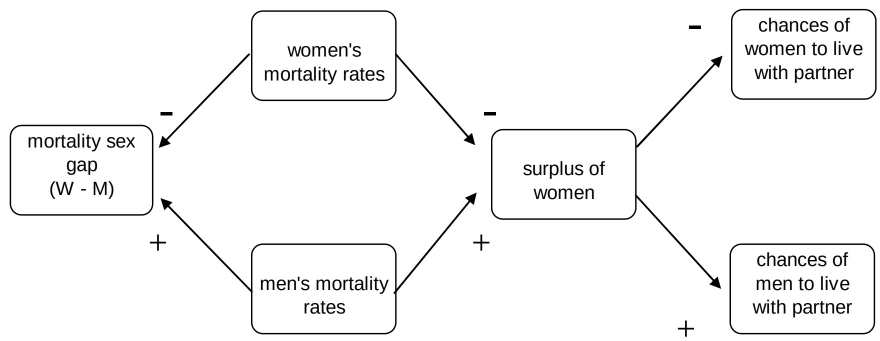
Sex & age	2002	2032	%points increase over 30 years		Sex & cohort in 2032	%points increase over 30 years
Keeping age groups constant					Keeping cohorts constant	
M 80-84	61.8	76.0	14.2		M 1948-52	-1.0
M 85-89	47.0	73.5	26.5		M 1943-47	-5.0
W 80-84	21.9	37.9	16.0		W 1948-52	-36.9
W 85-89	9.6	21.5	11.9		W 1943-47	-49.3

Men aged 85-89 experience an increase in the share that lives with a partner by 26.5 percentage points between 2002 and 2032. In this comparison we follow the same age group over time. The men who are aged 85-89 in 2032 were born in 1943-47. 30 years earlier, in 2002, these men were aged 55-59. At that time their share was five percentage points higher than the share of the same cohort in 2032; see the last column of table 1. For women in the age group 80-84 we notice an increase in the share that lives with a partner by 16 percentage points. But when we follow the birth cohort 1948-52, we see a *decrease* by 37 percentage points. Thus the shares in these cohorts who live with a partner were already high in 2002, in particular for women.

A further analysis is hampered by a lack of data on men and women who live with a partner. However, a preliminary analysis of the married (NB marital status, not household position!) population broken down by age and sex shows that cohorts born in 1930s and 1940s have higher shares married than both earlier and later cohorts. The earlier cohorts were hit by economic hardship during the 1930s and the Second World War. Later cohorts postponed marriage, and did not compensate this fully by cohabitation. They also experienced couple dissolution much more frequently than the cohorts born in the 1930s and 1940s did.

4.2 Mortality

When analysing the impact of mortality on the chances of elderly men and women to live with a partner, we used the following scheme. The surplus of women compared to men plays a key role here. When death rates of women increase, the surplus of women goes down, other factors remaining the same. Next, with fewer women compared to men, the chances for a woman to live with a partner (of the opposite sex) go up. Thus there is a positive relationship between the mortality of women and their chances to live with a partner, but it works through two *negative* paths: one from mortality to the surplus, and one form the surplus to the chances to live with a man.



For men, there is also a positive effect of mortality on the chances to live with a partner. But here the surplus of women is linked to mortality and those chances via two *positive* links. When death rates of men and women change at the same time, the effects on the chances to live with a partner cannot be predicted – this is an empirical matter.

We have performed a number of sensitivity computations. The most important ones are:

- A 30% increase or decrease in all death rates, irrespective of age or household position

1. only for women
2. only for men
3. -30% for men, +30% for women

4. No sex difference: women’s rates are those used in the Benchmark projection, while men’s rates are the same as women’s rates

- A 30% increase/decrease in the death rates for those who live with a partner (i.e. those with household position COH0, COH+, MAR0, or MAR+), irrespective of age

5. only for women

6. only for men

The change of 30 per cent that we used throughout was found after some experimentation – smaller changes implied effects on the chances to live with a partner that were not worth analysing. We increased or decreased death rates uniformly across al ages, and did not experiment with age-specific changes in the rates. The reason is that most of the mortality in Norway (as in many other developed countries) occurs in a limited age span, from age 60 and onwards, approximately. Thus the changes we assumed for the ages below 60 are not important for our findings.

Other parameters than death rates were set equal to their Benchmark values. Since we explicitly wanted to trace the effect of mortality on the chances to live with a partner, we did not include any consistency requirement for the number of deaths. Table 2 below summarizes the findings of these sensitivity computations.

Table 2. Share of elderly women and men who live with a partner. Benchmark projections, and percentage points deviations from Benchmark values in various sensitivity variants

	% women 80+ with partner				% men 80+ with partner		
	2002	2017	2032		2002	2017	2032
Benchmark	14.8	22.9	25.8		54.0	74.9	77.5
1. +30% women		+1.5	+1.4			-4.1	-3.2
2. +30% men		-2.0	-2.0			+6.4	+5.9
3. -30% men, +30% women		+4.8	+4.4			-11.1	-9.5
4. no sex difference		+4.6	+4.4			-10.5	-10.3
5. +30% women with partner		-0.9	-1.1			-2.4	-2.1
6. +30% men with partner		-1.6	-1.7			+1.9	+1.6

The deviations are computed as the Benchmark value minus the value in the sensitivity variant. Strong effects are found for two cases: first, when we reduce men’s death rates by 30 per cent, and at the same time we increase those for women by 30 per cent (nr. 3); second, when we reduce the mortality of men such that it equals women’s mortality (nr. 4). In both cases, the effects for men are stronger than those for women. Yet, in spite of the large changes in death rates compared to the Benchmark values, these sensitivity variants are not able to neutralize the increases in shares of elderly who live with a partner.

When we restrict the changes in death rates to those who live with a partner (variants nr. 5 and 6) we notice smaller effects than those that result from changed death rates for all persons, irrespective of household position (nr. 1 and nr. 2). The results obtained for elderly women in variant nr. 5, namely *lower* shares who live with a partner compared to the Benchmark situation, deserve some explanation. The flow diagram given above suggests that higher mortality leads to a lower surplus of women, and hence to a larger chance to live with a partner. While this still may be true, there is a second effect operating here, which must be stronger: When more women who live with a partner die, the share of those who do not live with a partner increases, and hence our variable of interest (the share that lives with a partner) decreases. We do not see the same effect for men in variant nr. 6: here the share of elderly men with a partner is *higher* than in the Benchmark situation. A possible explanation is that in this case, the impact of the female surplus (i.e. "shortage" of men) dominates over the direct effect of higher death rates for men with a partner.

4.3 Pair formation and dissolution

Processes of pair formation and pair dissolution are governed by rates that reflect changes in household positions. For pair formation these are: *from* CHLD, SIN0, SIN+, or OTHR *to* COH0, COH+, MAR0, or MAR+. For pair dissolution the rates reflect changes in the opposite direction. We increased or decreased those rates by 50 per cent for both sexes simultaneously. The reason why we did not analyse the effect of changes for one sex at the time is the following. LIPRO models the marriage market (and the cohabitation market) as a two-step procedure: initial rates lead to inconsistent numbers of men and women summed over all ages who "want to" marry (start a consensual union) during a certain projection interval; next, the consistency algorithm takes the harmonic mean of these inconsistent numbers, and adjusts initial age-specific numbers up for one sex, and down for the other sex. Thus, if we were to change the rates for one sex only, the results would partly be the consequence of implausibly strong imbalances in the marriage/cohabitation market. By changing the rates for both sexes at the same time, we avoid that problem to a large extent, since the Benchmark rates reflect the actual situation as observed in the Survey of Living Conditions in the years 1997-2002.

Table 3 shows a much stronger effect on the share of the 80+ who live with a partner caused by changes in pair dissolution, compared with the effect caused by pair formation. The reason is the fact that dissolution is observed, on average, at a higher age than pair formation. Thus it takes fewer years to see an effect of changes in pair dissolution on the population aged 80 and over, compared to changes in pair formation. Multi-state life tables based on household formation and dissolution rates as in the Benchmark projections show that the partnership is dissolved at a mean age of 44.4 years for men and 50.2 years for women; for pair formation the mean ages are 33.3 and 28.1 years, respectively. In the sensitivity variants those mean ages are slightly different, but the general pattern remains. (Dissolution of the partnership includes the death of the partner. This explains the high mean age of women, compared to that of men.)

Table 3. Share of elderly women and men who live with a partner. Benchmark projections, and percentage points deviations from Benchmark values in various sensitivity variants

	% women 80+ with partner				% men 80+ with partner		
	2002	2017	2032		2002	2017	2032
Benchmark	14.8	23.0	27.1		54.0	75.5	75.1
7. +50% pair formation		+0.2	+0.9			+0.2	+0.1
8. -50% pair formation		+0.1	-0.6			-0.7	-0.7
9. +50% pair dissolution		-4.0	-5.9			-6.2	-6.8
10. -50% pair dissolution		+5.7	+9.2			+6.4	+7.1

3.4 Entry into and exit from institutions

We changed the entry rates into institutional households for persons who lived as a couple (i.e. COH0, COH+, MAR0, or MAR+) by 50 per cent, irrespective of age (< 65) or sex. Exit rates from institutions back to a partner were also changed by that amount. The results of these four sensitivity variants are given in Table 4.

The assumption of a constant capacity of the institutional households (41,000 persons) implies that higher entry rates for persons who live with a couple, *ceteris paribus*, cause lower entry rates for persons in private households who do not live with a partner (most of them have household positions SIN0 or OTHR). When more persons who live in a couple move to an institution, and fewer who do not live in a couple do so, the effect is a decrease in the chances to live with a partner in a private household; see the results for the sensitivity variant labelled as "+50% entry". Also the directions of the effects of the other three variants are as expected. Yet the magnitudes are rather modest.

Table 4. Share of elderly women and men who live with a partner. Benchmark projections, and percentage points deviations from Benchmark values in various sensitivity variants

	% women 80+ with partner				% men 80+ with partner		
	2002	2017	2032		2002	2017	2032
Benchmark	14.8	23.0	27.1		54.0	75.5	75.1
11. +50% entry		-3.6	-3.9			-2.4	-2.3
12. -50% entry		+4.8	+5.3			+2.6	+2.5
13. +50% exit		+2.3	+2.5			+2.5	+2.8
14. -50% exit		-3.2	-3.6			-4.5	-5.1

4.5 Combined changes

So far we have seen that mortality is more important for the chances of elderly men and women to live with a partner than pair formation, pair dissolution, or entry into or exit from an institution. However, the various sensitivity variants cannot be compared directly, because we used a 50 per cent change in pair formation, and a 30 per cent change in mortality. In the sensitivity variant that follows we ask ourselves: how large changes in rates of mortality, pair dissolution, and entry into or exit from an institution are necessary, compared to the Benchmark, in order to neutralize the projected increase in the share of elderly men who live with a partner? In other words, how large change in Benchmark rates is necessary to keep that share at its level as observed in 2002, i.e. 54 per cent?

To answer this question, we tried to discover a number $0<K<1$, such that changing rates for

- mortality of women, pair dissolution of both sexes, and entry into institutions of men by a factor (1+K), and
- mortality of men and exit from institutions of men by a factor (1-K),

would result in a share of men aged 80+ who live with a partner equal to 54 per cent in 2032. Trial and error gave us the answer: K = 0.41. In other words, if one considers the increase in the chances of elderly men to live with a partner to be unrealistic, an increase (compared to

Benchmark levels) of female death rates, dissolution rates for both sexes, and entry rates of men into institutions by almost one-half, combined with a decrease of male death rates and exit rates from institutions by more than forty per cent will result in a share in 2032 that equals its 2002-value.

The forty per cent change in four components simultaneously (mortality, pair dissolution, entry into an institution, exit from an institution) results in a share of elderly men with partner in 2032 that is 77.5 – 54.0 = 23.5 percentage points lower than in the Benchmark situation. In case only one of these four components is changed by forty per cent at the time, we obtain smaller differences compared to the Benchmark situation (all values expressed as percentage points): mortality 13.1, pair dissolution 5.3, entry into an institution 0.3, and exit from an institution 4.2.[5] The sum of these values is 22.9 percentage points, slightly lower than the difference of 23.5 percentage points mentioned above. Thus small interaction effects are at work when we change the four components simultaneously. At the same time we note that mortality is by far the most important component, as expected.

5. Conclusions

The physical and emotional well-being of elderly persons depends strongly on their living arrangement – at the same time it is one of the determinants of their living arrangement. Thus when we note in a new household forecast that elderly men and women in Norway who live with a partner will increase faster than the total number of elderly (irrespective of living arrangement), an analysis of the factors that could cause this new trend is warranted. The variable of interest is the share of individuals aged 80+ who live with a partner. For men that share is expected to increase from 54 per cent in 2002 to 77 per cent in 2032; for women the expected increase is by 11 percentage points, up from 15 per cent in 2002.

Much of the increase in the share is already embodied in the forecast's jump-off population. The over 80 in 2032 were born in the 1930s and 1940s. Those cohorts lived and will live more often

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[5] These numbers for pair dissolution and entry into/exit from an institution are not directly comparable to those in Tables 3 and 4, for two reasons. First, we did not apply any mortality constraint in Section 4.5, whereas in Tables 3 and 4 deaths were constrained to numbers predicted by Statistics Norway. Second, the simulations in this paper revealed a problem with LIPRO's handling of consistency requirements, in particular under extreme conditions (e.g. -30% men and +30% women for mortality, or +/- 41% for four components combined). Under such conditions, LIPRO could not always satisfy the constant capacity requirement towards the end of the period. To keep these problems to a minimum, we formulated the constant capacity constraint for both sexes simultaneously in Sections 4.2 and 4.5, but for men and women separately in Tables 3 and 4.

in a relationship than earlier and later cohorts. The earlier cohorts were hit by economic hardship in the 1930s, and suffered from WWII. The later cohorts adopted a different behaviour with more frequent union dissolution than those born in the 1930s and 1940s.

A second important factor is mortality. At present, there is a large surplus of elderly women, caused by unfavourable mortality developments among men in the 1950s and 1960s. In recent decades, mortality of men improves more quickly than that of women, and this trend is expected to continue onto the future. This will reduce the surplus of elderly women, which in turn implies that the chances for elderly women to live with a partner will increase.

The impact of mortality on the chances of elderly men to live with a partner are more difficult to explain. Male mortality is expected to improve in the future; however, falling death rates should imply *lower* chances for men to live with a partner, because they become more abundant. When we expect an *increase* in this share, it might be the result of a simultaneous improvement of mortality for women.

Other components of change, such as pair formation and dissolution, or the entry into/exit from an institution, have only small effects on the chances for elderly men and women to live with a partner.

Although we have not been able to give an entirely satisfactory explanation (other than that it is already embodied in the current population) for the increasing share of elderly men with a partner, we believe that it is real, and not an artefact of the household simulations. In a counterfactual simulation, we succeeded in neutralizing the expected increase, by applying 41% *higher* death rates for women, divorce and separation rates for both sexes, and entry rates into institutions of men, *together with* 41 per cent *lower* death rates and exit rates from institutions. We consider a change by 41 per cent of the parameters of the household forecast as rather unrealistic. Hence the increase in the share of elderly men who live with a partner is real, although it could be weaker or stronger than the household forecast shows.

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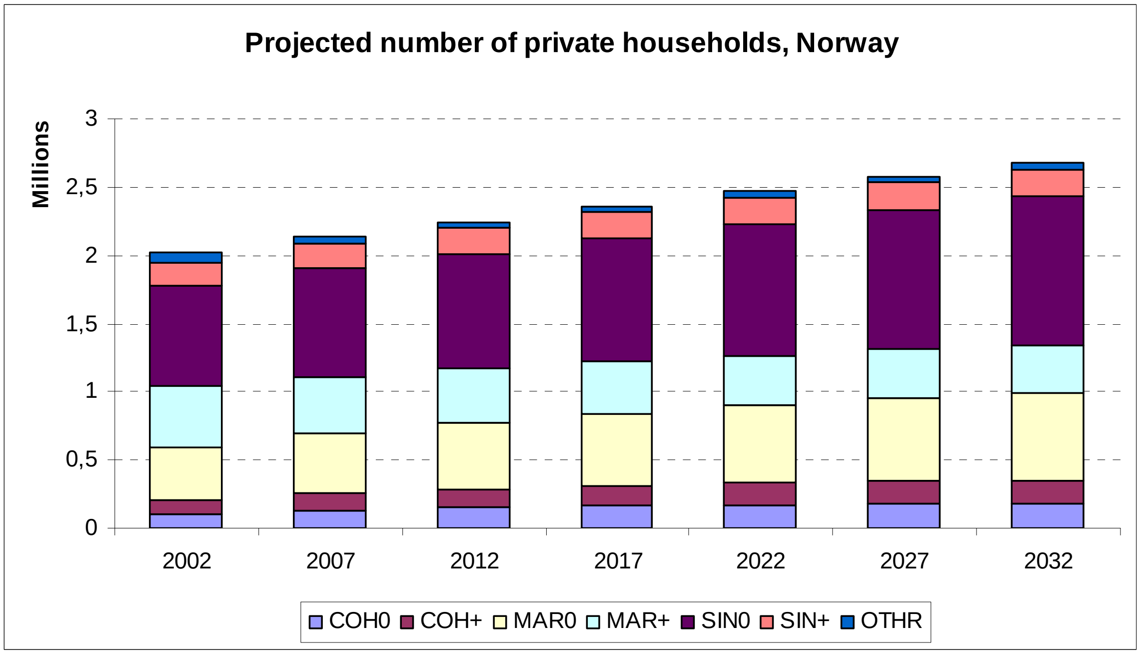
Figure 1



Projected number of private households, Norway
Millions
3
2,5
2
1,5
1
0,5
0
2002
2007
2012
2017
2022
2027
2032
COH0
COH+
MAR0
MAR+
SIN0
SIN+
OTHR

Figure 2a

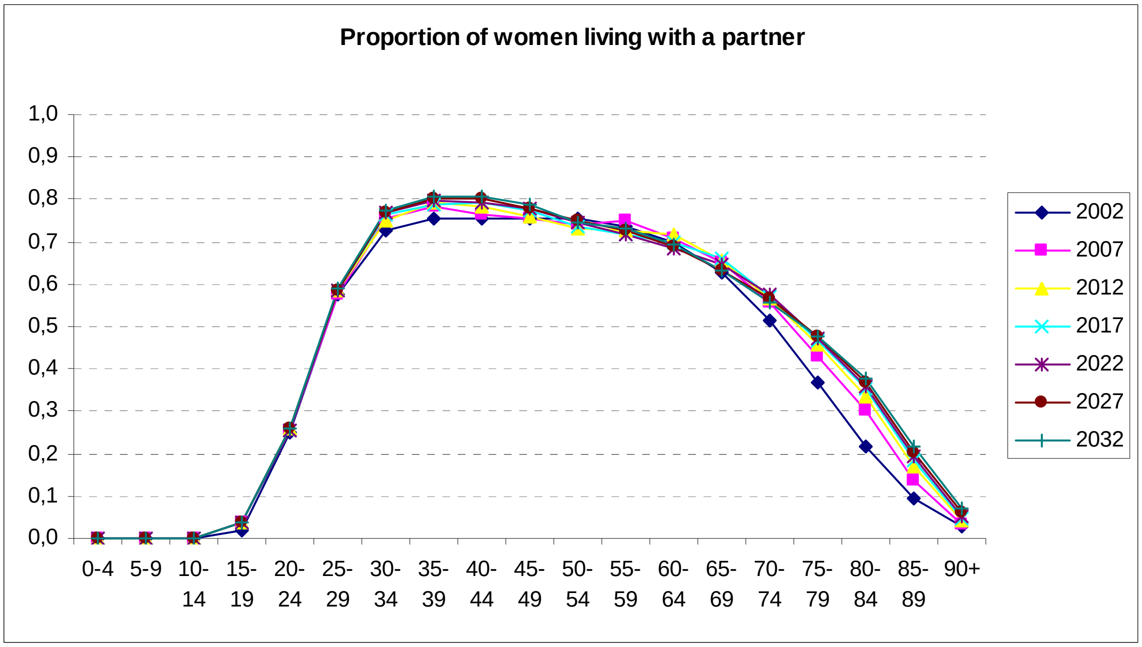


Figure 2b

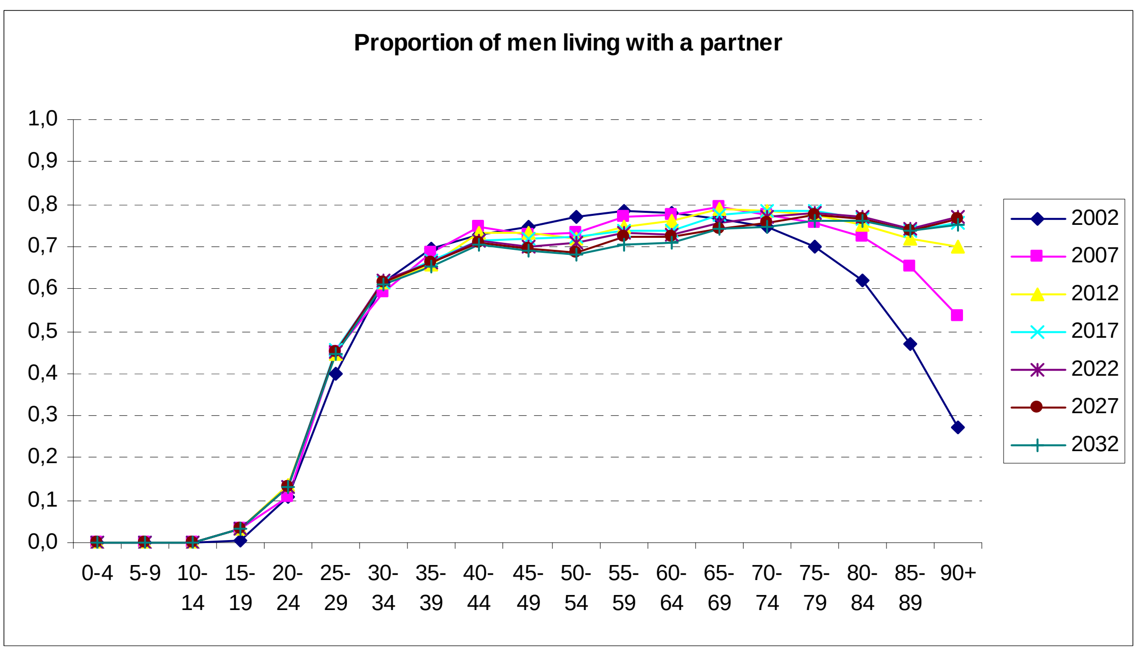
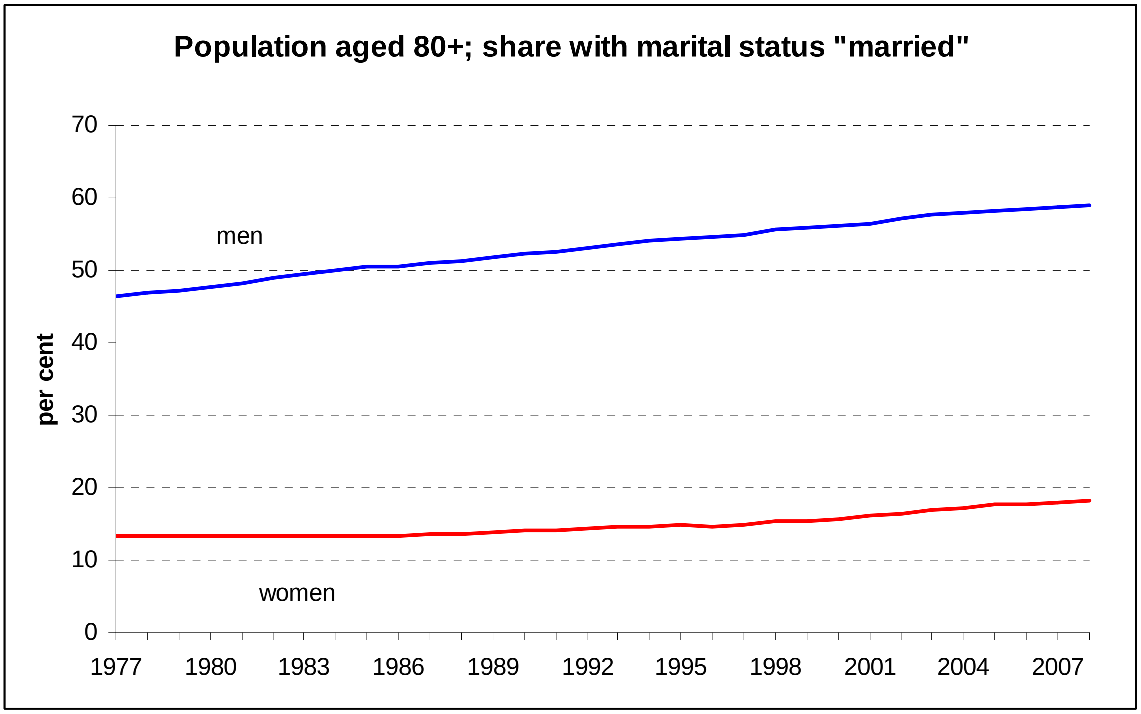


Figure 3



Population aged 80+; share with marital status "married"
70
60
50
40
30
20
10
0
per cent
men
women
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007