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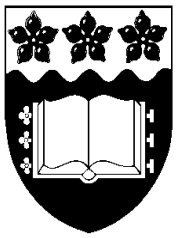
Peter M. Siminski
University of Wollongong, siminski@uow.edu.au

Oleg Yerokhin
University of Wollongong



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Is the Age Gradient in Self-Reported Material Hardship Explained by Resources, Needs, Behaviours or Reporting Bias?

Peter Siminski

and

Oleg Yerokhin

School of Economics
University of Wollongong

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Peter Siminski and Oleg Yerokhin
University of Wollongong

Abstract

Older people report much less hardship than younger people in a range of contexts, despite lower incomes. Hardship indicators are increasingly influential, so the source of the gradient has considerable policy implications. We propose a theoretical and empirical strategy to decompose the sources of this relationship. We exploit a unique feature of the Household, Income & Labour Dynamics Australia (HILDA) survey, which collects reports of hardship from all adult household members, facilitating within-couple estimates. The majority of the relationship is explained by observed resources, particularly wealth and home ownership. One third of the relationship is explained by unobserved differences between households, which we interpret as age-related behavioural choices. Reporting error does not appear to contribute to the age gradient.

JEL codes: I32; J14; D63; D39
Keywords: Hardship, age.

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1 Introduction

In assessing the adequacy of social assistance and in identifying groups in need of support, governments and policy makers are increasingly making use of 'material hardship' or 'deprivation' indicators, which stem from the seminal work of Townsend (1979). Whilst such indicators vary considerably between countries and data sources (see the review by Boarini and Mira d'Ercole 2006), their common objective is to directly measure the prevalence of poor outcomes (associated with a shortage of money). This contrasts with income poverty measures which consider only resources, seen by some as 'indirect' measures of poverty (Ringen 1988). As expressed by leading researchers in this field, 'indicators of material deprivation have swept the social policy world as a complement, or even as an alternative, to household income as the primary measure of living standards.' (R Berthoud and Bryan 2008: 14). This is especially true in Europe. Hardship indicators are a component of the Irish government's 'consistent poverty' definition, within its national strategy to promote social inclusion (Government of Ireland 2007). The British Department of Work & Pensions includes deprivation within its suite of child poverty indicators, in the context of its aim to eradicate child poverty by 2020 (Department of Work and Pensions 2003). A set of material deprivation indicators is included in the Income, Social Inclusion and Living Condition (EU-SILC) survey, a main source of information on income, poverty, social exclusion and living conditions for policy monitoring at the EU level (Guio 2009). The OECD has conducted cross-national research on deprivation (Boarini and Mira d'Ercole 2006). Mature programs of government and academic work in this field exist in Australia (Bray 2001; Headey 2005; McColl et al. 2001; Saunders and Naidoo 2009; Travers and Robertson 1996). Hardship questions are also present in large nationally representative surveys in other countries such as the Survey of Income and Program Participation (USA) and the German Socio-Economic Panel.

Despite this, very few papers have addressed material hardship in the mainstream economics literature. The leading exception is Mayer & Jencks (1989), who conducted a survey of Chicago residents in which respondents were asked about the incidence of hardship including inability to pay rent and utilities bills due to a shortage of money. Their analysis focussed on the failure of income to explain

differences in self-reported hardship. They conclude that income poverty measures are of limited use and that direct measures of material hardship should be regularly monitored by policy makers. Nevertheless, academic economists have clearly been reluctant to engage with these constructs (some further exceptions are Breunig et al. 2007; Iceland and Bauman 2007; Saunders and Bradbury 2006; Saunders and Naidoo 2009). There are several good explanations for this. One relates to concerns over the reliability of self reports, to which economists are traditionally suspicious. There is also ambiguity over the roles of resources[2] and behavioural choices in determining the presence of a particular form of hardship, and so there is no link between the constructs being measured and economic theories of welfare. We come some way towards addressing these issues. Our theoretical framework explicitly accounts for the roles of observed resources, latent behavioural choices, and the presence of non-ignorable reporting issues in self reported hardship. Our empirical strategy facilitates an attempt to decompose the contributions of these factors.

A consistent finding across countries, time and most indicators is a negative cross-sectional relationship between age and self-reported hardship. Older people report much less hardship, despite having considerably lower incomes. In our raw data, coupled people aged in their 20s reported 9 times more hardship than those in their 70s, despite having almost twice their average income. Using similar data, Saunders & Bradbury (2006) report that 'while the aged poverty rate is more than twice the national rate, aged hardship is less than one-third of the overall rate.' Similar findings are reported in many contexts. For example, Mayer & Jencks (1989) found that 'families with heads over the age of 65 need only 36 percent as much income as younger families of the same size in order to end up with the same number of hardships'. According to the review of Boarini and Mira d'Ercole (2006), 'In all OECD countries, young people are highly exposed to risks of deprivation'. (See also R. Berthoud et al. 2006; Bray 2001; Headey 2005; Lollivier and Verger 1997; Marks 2007; Mirowsky and Ross 2001; Saunders and Naidoo 2009).

The interpretation of such findings is of considerable policy importance. Older people account for an increasing share of the population in most countries. They continue to rely on government pensions in many countries. As a consequence, claims for increases in pension levels have increasing political clout, as well as growing

[2] Resources may include financial resources (such as income and wealth), time and human capital (such as education and health).

budgetary implications. In assessing pension adequacy, it is important to understand the reasons for the low prevalence of self-reported hardship amongst older people. Similarly, policy makers would benefit from knowing whether self-reported hardship amongst younger people reflects a lack of resources, behavioural choices, or a greater propensity to report a given level of hardship. The credibility of hardship indicators as policy relevant tools must depend on the ability of researchers to confidently explain striking findings such as the age gradient within sound theoretical and empirical frameworks.

The observed 'age gradient' may stem from cohort differences, or it may be related to ageing itself. We do not attempt to distinguish between these two potential sources and we do not need to do so to achieve our aims. Even though terms such as 'age-related' or 'age effects' are used throughout the paper, we do not imply that these stem from factors caused by 'ageing' and we do not rule out cohort effects.

Our main aim is to decompose the raw cross-sectional age gradient in self-reported hardship into components explained by resources, needs (such as family composition), behavioural choices, and reporting bias. Little attention has been placed in the existing literature on explaining the age gradient.[3] A key feature of our empirical strategy is motivated by a unique aspect of Australia's Household, Income and Labour Dynamics Australia (HILDA) survey. In HILDA, both members of couple households are asked to respond to the hardship questions. This provides multiple reports of (household level) hardship, provided by respondents of different ages.[4] We argue that for household-level hardship indicators, an age gradient *within* couples reflects reporting differences. We combine such estimates with the results of a set of corresponding cross-sectional models to conduct the decomposition.

We find that most of the age gradient in household level hardship indicators is explained by the correlation between age and observed resources. However, almost one third of the gradient is explained by unobserved differences between households, which we interpret to reflect age-related behavioural choices. There is no evidence

[3] Using panel data, Berthoud (2006, 2009) attempted to unpick cross-sectional age differences in reported hardship by distinguishing between ageing effects from that of cohort differences. They do not explicitly seek to decompose the effects of resources, behavioural choices and reporting.

[4] The questions are asked of all adults in the household. We restrict the analysis to members of couples living together, since we are not confident that other household members, such as dependent children, are sufficiently aware of the household's ability to pay bills and mortgage/rent on time, which are two of the key hardship indicators.

that reporting differences contribute to the age gradient, despite considerable precision in our estimates which stem from a large sample.

The remainder of the paper is organised as follows. Section 2 discusses the many potential explanations for the age-hardship gradient. Section 3 outlines our theoretical model and identification strategy. Section 4 describes the features of the HILDA data and our econometric models. Results are presented in Section 5, while Section 6 concludes with recommendations to researchers and policy makers.

2 The complex relationship between self-reported hardship and age

There exists considerable evidence that low income and hardship approaches produce drastically different results when comparing the prevalence of disadvantage amongst people of different ages. Despite the fact that a large proportion of older people are income poor, they seem to suffer considerably less from hardship compared to other segments of the population. This finding is consistent across time, countries and specific indicators (R. Berthoud et al. 2006; Bray 2001; Headey 2005; Lollivier and Verger 1997; Marks 2007; Mayer and Jencks 1989; Mirowsky and Ross 2001; Saunders and Bradbury 2006; Saunders and Naidoo 2009).

To interpret this finding, two questions must be answered. First, to what extent can it be explained by age-related *reporting* error? Second, if the gradient reflects genuine differences in hardship, is this due to a shortage of resources, or a reflection of behavioural choices that are correlated with age? Policy makers may be more concerned about hardship caused by a shortage of resources than hardship due to behavioural choices.[5]

There are many reasons to be concerned about the possibility of bias due to age-related differences in reporting. Most of these stem from the psychological literature on survey response. Survey response is associated with relatively high cognitive demands and small rewards. A response to a single question requires tasks of question interpretation, retrieval of relevant memories, 'formatting' or arranging one's thoughts into the response format requested, and possibly censoring the report due to perceived social desirability or self-presentation motives (N. Schwarz 2007). It

[5] On the other hand, if poverty relief is motivated by outcome egalitarianism, then the reasons for experienced hardship may not always be relevant. Nevertheless, to differentiate between the sources of the age gradient is likely to be policy relevant.

is well established that the cognitive faculties associated with survey response decline with age (Norbert Schwarz et al. 1998; Verhaeghen and Salthouse 1997). Given this, older people are more likely to resort to 'satisficing' strategies, negotiating the survey response process more superficially, in order to reduce the burden (Knauper 1999). As a result, the context of survey questions can affect responses in ways that vary systematically by age. For instance, a general result from this literature is that older people are less sensitive to question order effects, but more sensitive to response order effects within multiple choice questions. In the words of the world leader in that literature, 'such age-sensitive context effects can severely compromise substantive conclusions about cohort differences or changes across the life span, putting theory tests … at the mercy of more or less haphazard decisions of questionnaire design.' (N. Schwarz 2003: 590) Further to this, Siminski (2008) argues that a specific ordering within a battery of questions (such as that in the HILDA hardship questions) can lead to systematic upward or downward bias in the responses to *all* of those questions.

Independently of the context effects argument, it is possible that older people are less likely to recall a given hardship incident, or to recall whether or not it occurred it within the current calendar year.

It is also possible that bias due to social desirability or self-presentation is age-related, perhaps reflecting cohort differences or ageing-related personality changes. There is evidence that age is a strong (positive) predictor of reporting socially desirable attitudes and behaviours across a range of surveys and modes of administration (Gove and Geerken 1977; Holbrook et al. 2003; Lewinsohn et al. 1993). There is some qualitative evidence that older people are reluctant to admit to needing help when in need (Dominy and Kempson 2006; Moen 1977-78). Related to this, whilst older people frequently report the absence of various necessities, they are much less likely to attribute this to a shortage of money (R. Berthoud et al. 2006; Dominy and Kempson 2006; McKay 2004). This has important implications, since the majority of hardship indicators explicitly aim to only include those occurrences that are attributed (by the respondent) to a shortage of money.[6] The extent to which

[6] In the studies referred to (Berthoud, Blekesaune, and Hancock 2006; McKay 2004; Dominy and Kempson 2006), it is difficult to gauge whether this reluctance to attribute such outcomes to a shortage of money reflects age-related social desirability bias, or age-related consumption preferences. For example, some people may not have a monthly night out, simply because they would prefer not to. Compared to those studies, the *household-level* hardship indicators that we use from HILDA are narrow and focussed on clear necessities. Few people would attribute difficulties with paying bills or heating the home to a lack of desire for electricity, a telephone, housing or heating. Thus we do not see

social desirability is a possible source of the age gradient is difficult to gauge. The evidence that social desirability is correlated with age appears clear. And whilst there is consensus that social desirability is less of an issue in self-completed surveys, it does not follow that this mode of administration is free form such bias (Bradburn et al. 2004: 100). In any case, our identification strategy arguably accounts for social desirability bias.

There are many potential explanations for the observed negative relationship between material hardship and age. The difficulty in distinguishing between different explanations stems from the fact that only self-reported measures of hardship are typically available to a researcher. However, the value of these indicators rests on analysts' ability to account for the competing explanations.

3 Theoretical Model and Empirical Strategy

3.1 Household-level Hardship

We focus attention primarily on household-level material hardship indicators.[7] Assume that for a given household *j*, material hardship (M*) at a point in time is a function of available resources (R), 'needs' (N) and behavioural choices (B*).

$$M_j^* = f(R_j, N_j, B_j^*) \tag{1}$$

M may be a count of binary hardship indicators or a single binary indicator. The functional form of the model is also left unspecified for now. We return to these issues in Section 4. Hardship and behavioural choices are not directly observed, as indicated by the superscripts (*).

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a role for preferences contributing to the age gradient in this way. It seems more likely that any reluctance to attribute such outcomes to a shortage of money would reflect social desirability bias. It is also noteworthy that the 'shortage of money' issue is treated quite differently in the respective data sets. The studies referred to above draw on survey data where respondents are first asked whether they have 'gone without' certain items and then asked explicitly whether this was due to a shortage of money or other reasons. In HILDA, respondents are asked a single battery of questions about whether they had certain experiences due to a shortage of money (see Section 4). It seems likely that this form of social desirability bias would be a greater issue when affordability issues are explicitly highlighted.

[7] As will be detailed in Section 4, these indicators include inability to pay mortgage or rent on time, inability to pay electricity, gas, or telephone bills on time, and inability to afford adequate heating for the home.

Resources include financial resources (income, wealth, etc.), human capital (education, health) and non-market time available for domestic production. Such resources partly reflect behavioural choices made over the life-course. However, we are not interested in the determinants of resources. Rather, we treat resources as exogenous determinants of material hardship at a point in time.

For a given set of resources, material hardship also depends on 'needs'. In this context, needs differ according to remoteness[8], household composition (the number, age and health of children), as well as the health status of household members. This effect of health on hardship stems from the allocation of resources (time and money) to maintain or improve health, instead of on other forms of consumption. The dual role of health as a productive resource and as a drain on other resources is consistent with models of health production (Grossman 1972; Jacobson 2000).

As mentioned above, behavioural choices are a determinant of resources. There is also a direct role for behavioural choices in the model. For a given set of resources and needs, the presence of hardship depends on behavioural choices. An individual's behaviour may reflect rational preferences over consumption, time and risk. It may also reflect mistakes in judgment, for instance due to a lack of experience with finances. Whilst individual household members may exhibit different behavioural choices, household-level hardship depends only on some aggregation of behavioural choices within the household. Similarly, individuals may have different needs and individual resources. Again, household level hardship depends only on an aggregation of resources and needs.

Age, in itself, has no direct role in the theoretical model. Rather, the relationship between age and hardship may stem from correlations between age and the determinants of hardship, specified above.

Age may also be correlated with reporting bias. This may be due to age related social desirability bias. It may also relate to the effects of cognitive ageing on survey response.[9]

Thus whilst there is no direct relationship between age and hardship in (1), we posit a relationship between age and *observed* (reported) hardship. Both members of

[8] Prices, as well as the availability and accessibility of goods and services may vary between major cities, regional and remote areas.

[9] Cognitive ability may be correlated with mental health status indicators. Therefore, health control variables may pick up not only the effects of health status as a 'resource' and as a 'need', but also through a possible link with reporting bias.

the couple report on the same hardship indicators. Observed hardship is specified as a function of the age (A) of respondent *i* and actual hardship.

$$M_{ij} = g(A_{ij}, M_j^*) \tag{2}$$

The relationship between observed hardship and its identifiable determinants is given in (3):

$$M_{ij} = h(A_{ij}, R_j, N_j, \theta_j) \tag{3}$$

Observed hardship for person *i* in household *j* is a function of age (A), resources (R) and needs (N), and unobserved household characteristics (θ).

Our aim is to decompose the raw relationship between age and observed hardship. We decompose the raw age effect by sequentially adding controls as follows. We begin by estimating the bivariate relationship between observed hardship and age:

$$M_{ij} = h_1(A_{ij}; \alpha_1) \tag{4}$$

The parameter α_1 represents the size of the raw relationship. It's interpretation varies with the empirical specification, to be discussed in section 4.2. We then re-estimate the model with the addition of controls for resources:

$$M_{ij} = h_2(A_{ij}, R_j; \alpha_2, \beta_2) \tag{5}$$

The parameter α_2 represents the size of the age relationship after controlling for resources. For completeness, β_2 is the vector of parameters associated with the control variables. The difference between the estimated age effects in (4) and (5) (α_1 and α_2) represents the component of the raw relationship between age and hardship that is explained by age differences in observed resources.[10] Next, we add controls for needs:

[10] Notwithstanding the complications of interpreting the effects of health on reported hardship.

$$M_{ij} = h_3(A_{ij}, R_j, N_j; \alpha_3, \beta_3) \quad (6)$$

Similarly to above, the parameter α_3 represents the size of the age relationship after controlling for resources and needs. The difference between α_2 and α_3 represents the component of the age relationship explained by age differences in needs. Finally, we include household fixed-effects:

$$M_{ij} = h_4(A_{ij}, \theta_j; \alpha_4) \quad (7)$$

In equation (7), the household fixed effect (θ) accounts for all factors that are common to members of a couple.[11] The parameter α_4 is identified through differences between spouses in reported hardship. It represents the effect of age after controlling for all household level characteristics. The difference between α_3 and α_4 represents the component of the age relationship explained by unobserved differences between households that are correlated with age.[12] In particular, this includes age-related differences between households in behavioural choices. Finally, α_4 can be interpreted as the component of the age effect that is explained by reporting errors correlated with age.

3.2 Individual-level Hardship

Some forms of hardship are more reasonably interpreted as individual-level indicators since they can plausibly be experienced by one spouse without being experienced by the other.[13] It is more difficult to unpick the determinants of the raw age-hardship correlation for such indicators, as detailed briefly in this sub-section.

[11] The factors that are common to members of the couple include all (unobserved and observed) household level characteristics. This includes observed resources and needs (R and N) and so there is no need to control for these explicitly in this model. In the analysis to follow, variants of (7) are also estimated with additional individual-level controls for resources and needs which vary between members of a couple (health, labour force status, education, personal income). It will be shown that, consistent with the theoretical model, their inclusion makes no substantive difference to the estimated age coefficient.

[12] This is because unobserved household characteristics are controlled for in (7), but not in (6). This is the only source of discrepancy in the results between the two models.

[13] These include pawning or selling something, missing meals, asking for financial help from friends or family, and asking for help from welfare / community organisations.

In this case, material hardship experienced by person *i* may be a function of the resources, needs and behavioural choices of individuals within the household, and not just their household-level aggregations. Thus the individual-level expression that corresponds to equation (1) is:

$$M_{ij}^{*} = f(R_{ij}, R_{j}, N_{ij}, N_{j}, B_{ij}^{*}, B_{j}^{*}) \tag{8}$$

Similarly to our household-level strategy, we seek to identify the components of the age relationship attributable to observed resources, needs, and unobserved household characteristics by sequentially adding controls. The main limitation here is that the age coefficient in the fixed-effects model is not as easily interpretable. It may reflect age-related reporting differences. But it may also pick-up age differences in individual behaviours. In addition, we can not rule out the possibility that resources are not shared fairly within the household. If unequal sharing of resources is correlated with age (conditional on covariates), this may also contribute to the age coefficient.

4 Data and methods

4.1 Sample construction

The data used in this paper come from the Household, Income and Labour Dynamics in Australia (HILDA) survey. HILDA is a nationally representative household panel survey which commenced in 2001. Respondents are interviewed annually, covering a broad range of economic and social variables. The Wave 1 sample consisted of 7,682 households and 19,914 individuals. The analysis reported in this paper draws on the confidentialised unit records for waves 1-7 (release 7.0). Because the identification strategy exploits intra-household variation in the propensity to report hardship, the sample consists of coupled people living with their partner in a given year. The unit of analysis is the person-year. There are overall 52,648 person observations in 26,324 couple-years across 11,578 different couples. After dropping

people with missing household-level hardship indicators, we are left with 48,089 observations.[14]

The analysis in this paper focuses on the responses to seven items from HILDA's self-completed questionnaire related to experiences of material and financial hardship. These questions ask whether the respondent had any of the following experiences since the start of the calendar year *due to a shortage of money*: (1) could not pay electricity, gas, or telephone bills on time, (2) could not pay mortgage or rent on time, (3) has pawned or sold something, (4) went without meals, (5) was unable to heat home, (6) asked for financial help from friends and family and (7) asked for help from community or welfare organization. We regard (1), (2) and (5) as household-level indicators. We construct a cumulative index of household-level hardship by summing those three household-level indicators for each respondent, which is the primary dependent variable in most of the analysis. A simple count is justified with reference to Butterworth & Cosier (2005). Conducting factor analysis of the seven indicators in HILDA, they advocate a single factor model. Further, the factor loadings were quite similar across indicators, leading them to conclude that a simple count is an adequate summary hardship indicator. We also check robustness of our results by analysing each binary indicator separately.

As described in Section 3, control variables represent 'resources' and 'needs', with health and disability spanning both categories. Health status is measured using the eight SF-36 summary scales for both members of the couple.[15] Each scale ranges from 0 to 100, representing bodily pain, general health, mental health, physical functioning, role-emotional, role-physical, social functioning and vitality, respectively. A disability status variable indicates the presence of a long-term condition, impairment or disability which has lasted, or is likely to last, 6 months or more; restricts everyday activity; and can not be corrected by medication or medical aids.

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[14] Observations are also dropped if relevant control variables are missing. Some key controls (especially wealth) were only collected at particular waves. Accordingly, the sample size is much smaller in the models which use such controls. Given the pooled-cross sectional nature of the analysis, such sample restrictions are not associated with any substantive risk of sample selection bias.

[15] The SF-36 scales are derived from self-reports to 36 questions. For explanation of SF-36 see Je Ware et al., *Sf-36® Health Survey Manual and Interpretation Guide* (Boston: New England Medical Center, The Health Institute, 1993).. For evidence of favourable psychometric properties of SF-36 in HILDA, see Butterworth & Crosier P. Butterworth and T. Crosier, 'The Validity of the Sf-36 in an Australian National Household Survey: Demonstrating the Applicability of the Household Income and Labour Dynamics in Australia (Hilda) Survey to Examination of Health Inequalities', *BMC Public Health,* 4/44 (2004), 1-11..

Other included 'resource' variables are household income, net worth and housing tenure, and for both members of the couple: education, labour force status and weekly hours in paid work.[16] Net worth is only recorded in Waves 2 and 6.

'Needs' controls include geographic remoteness indicators, the number of other household members by age group, and the number of people in the household with disabilities (excluding the couple).

In some models, we also include as controls a set of personality scales derived from the "Big 5 Personality Inventory" (Saucier 1994), which consists of measures of extroversion, agreeableness, conscientiousness, emotional stability and openness to experience. The propensity to report and/or experience hardship can depend on person's attitude towards life circumstances. Thus personality attributes may be 'resources', but they may also capture responding differences. We address this ambiguity by comparing the effect on reported household-level hardship of the respondent's personality to that of their partner's personality. If the effects are similar, we conclude that personality primarily operates as a resource. If they are different, we conclude that personality affects reporting. A second test of whether personality affects reporting is whether the personality variables are significant in the fixed effects household level hardship models. The personality tests were administered only in the 5th Wave of HILDA. We use these measures in conjunction with responses collected in other waves under the assumption that personality measures are constant in the short term (over the sampling period).

The overall and age specific sample means of all variables used in the paper are presented in Table 1. The average number of hardship indicators reported across all ages was 0.39 overall, and 0.21 for the household-level indicators. The indicators reported most frequently were 'could not pay electricity, gas, or telephone bills on time' (13% of respondents), 'sought financial help from friends or family' (10%) and 'could not pay mortgage/rent on time' (6%). As can be seen from the table there is a strong and consistent negative association between age and reported hardship. On average, respondents aged 20-29 (20s) reported 9 times more hardship indicators than those aged 70-79 (70s), or 7 times more for the household-level indicators. For each

[16] Hours in paid work accounts for time available for household production. Labour force status is treated as a resource since employment can provide non-pecuniary benefits through social networks and other workplace resources. Labour force status could also be seen as a determinant of 'needs', since employment may be associated with additional costs, as can unemployment, relative to being out of the labour force.

age group, the mean number of hardship indicators reported was less than that of each younger age group. Figure 1 displays this comparison in more detail, reporting the mean number of household-level hardship indicators reported by single year of age. This figure affirms the strong negative relationship between age and hardship, which closely resembles an exponential form. Figure 2 shows the distribution of the household-level hardship count variable. The distribution is characterised by a long tail, which is typical in count data with a low mean. Figures 1 and 2 together suggest that it is reasonable to assume a Poisson data generating process when specifying a model for the cumulative index of hardship.

When looking at the individual hardship indicators we observe a similar pattern, varying only by the strength of the age association (Table 1). The largest age gradient is observed for seeking financial help from friends/family, which 20s were 19 times more likely to report than 70s. Respondents in their twenties were also 14 times more likely to report going without meals and 10 times more likely to pawn or sell something. The smallest age gradients are for being unable to heat the home (20s were 2.3 times more likely to report as 70s) and for seeking financial help from welfare/community groups (4.1 times as likely).

One can also observe that despite reporting less hardship, older people have a number of characteristics that would usually be associated with greater risk of hardship. In particular, older people have much lower income: mean household income of 60s and 70s is lower than for each younger age group, with mean household income of 70s less than half that of 30s, 40s, and 50s, respectively. Older people also have poorer health, with lower scores on six of the eight SF-36 indicators (the exceptions are mental health and vitality, which vary little with age). Similarly, disability rates are more than 4 times higher amongst 70s compared to 20s. Finally, older people have lower educational attainment. The proportion of 70s with a degree or higher qualification is 3 times less than amongst 30s and the proportion of 70s who did not complete year 12 is 3 times higher than amongst 20s.

On the other hand, older people have several characteristics which should be associated with lower incidence of hardship. Not surprisingly, older people have much higher rates of home ownership. More than 80% of 70s are outright home owners, compared to 6% of 20s. Partly reflecting this, older people also have higher net worth. Mean household net worth peeks at $1.06M for 60s. Even though it falls to $687k for the 70s age group, this is still much higher than net worth of 20s and 30s.

Reflecting low workforce participation, mean hours of paid work are much lower amongst older people, leaving more time available for domestic production. Finally, older people are typically part of smaller households, thereby requiring fewer resources to attain an equivalent standard of living. For example, the mean number of persons per household was 79% higher for 30s, compared to 70s. Table 1 also shows that younger people are slightly more likely to live in major cities. On average, younger people are more likely to be extroverted, while older people are more likely to be conscientious and emotionally stable. The average older person is also less open to new experiences.

4.2 Empirical models

To accommodate the count nature of the dependent variable we model the observed hardship index as having a Poisson distribution with exponential conditional mean function:[17]

$$E(M_{ij} \mid x_{ij}) = \exp(x_{ij}\beta). \qquad (9)$$

The estimated coefficients β represent semi-elasticities of the conditional mean with respect to a given covariate. This model is used to estimate the effect of age on the cumulative index of hardship in the pooled cross-sectional models.

To implement the corresponding couple-fixed effects models we use the Poisson fixed effects estimator (Hausman et al. 1984; Wooldridge 1999). In this model the number of hardship instances reported by person i in couple j is assumed to have Poisson distribution with conditional mean function given by:

$$E(M_{ij} \mid c_j, x_{ij}) = c_j \exp(x_{ij}\beta) \qquad (10)$$

where c_j is the multiplicative fixed effect.

In the analysis of individual hardship indicators, we estimate cross sectional and couple-fixed effects logit models. The cross-sectional logit model specifies the

[17] Thus the link function $h(.)$ in equations (4), (5) and (6) is assumed to be exponential in the main models. We test sensitivity to an alternate linear specification of the $h(.)$ function using OLS.

probability of 'success' in the binary indicator as a logistic transformation of the linear function of explanatory variables:

$$P(M_{ij}=1 \mid x_{ij}) = \Lambda(x_{ij}\beta) = \frac{\exp(x_{ij}\beta)}{1+\exp(x_{ij}\beta)} \tag{11}$$

The fixed-effects equivalent of (11) is:

$$P(M_{ij}=1 \mid x_{ij}, c_j) = \Lambda(x_{ij}\beta + c_j) = \frac{\exp(x_{ij}\beta + c_j)}{1+\exp(x_{ij}\beta + c_j)} \tag{12}$$

The parameters in (12) are consistently estimated by Maximum Likelihood, after specifying the joint distribution of M_{1j} and M_{2j} conditional on the sum of observed M within j (Wooldridge 2002). The fixed-effects logit model avoids the incidental parameters problem of the corresponding probit model. Whilst marginal effects cannot be computed for the fixed-effects logit model, odds ratios are readily obtainable.

Cluster-robust standard errors, which take account of repeated observations over time, are reported for all models.

5 Results

5.1 Cross-sectional results for household-level hardship index

Estimation results from the cross-sectional Poisson regressions[18] are presented in Table 2. The dependent variable here is the number of reported household-level hardship indicators, with possible values consisting of the integers from 0 to 3. We focus on the estimated coefficients rather than marginal effects because the coefficients can be conveniently interpreted as semi-elasticities of the cumulative hardship count with respect to each explanatory variable.

Model 1 estimates the relationship between the incidence of hardship and age ignoring all other covariates. The estimated co-efficient suggests that an increase in

[18] The implications of the analyses reported in Tables 2 and 3 are unchanged when linear models are used instead of Poisson models.

age by a single year is associated with approximately 4% less reported hardship.[19] This implies that a decrease in age of, say, 40 years, is associated with an increase in reported hardship by a factor of $e^{(-0.0405 \times -40)} = 5$.

Model 2a adds all 'resources' controls with the exceptions of wealth, housing tenure and health status. The resulting age relationship is slightly stronger, with the effect of one additional year of age decreasing the expected hardship count by 4.7%. This increase in the age parameter is driven by income and education, both of which are significant determinants of hardship, and which favour younger people. Nevertheless, their inclusion only modestly increases the age effect.

In Model 2b we add wealth and housing tenure, both of which heavily favour older people. Since wealth is only measured in waves 2 and 6, the sample size is decreased accordingly. These inclusions have a large effect on the age parameter, reducing it to -0.019. Indeed wealth and housing tenure alone explain over two-thirds of the raw age effect. Nevertheless, the age relationship is still highly significant and of considerable magnitude.

Next we add health and disability status controls (Model 2c), which result in only a small increase in the age effect. Whilst few of the health controls are individually significant, health is highly significant in a joint test.

Taken together, Models 1 to 2c suggest that age differences in resources account for about half of the raw age-hardship relationship. Whilst older people have less income, education and health, these are more than offset by their higher wealth and home ownership.

Model 3 adds controls for 'needs'. Unsurprisingly, the numbers of people in the household in each age group are significant determinants of hardship, as resources

[19] This result is stable across the time period covered by the data. For example, the age parameter is -0.039 when the sample is restricted to the first 3 years and -0.041 when restricted to the last 3 years. The difference between the two is not statistically significant (p=0.62). The age parameter is slightly smaller (-0.033) when singles living alone are added to the sample (total N = 60,516), or if the sample is further extended to include everyone except those living with their parents (-0.033; N = 70,116). The age parameter falls to -0.019 when all persons are included (N = 80,074). This reduction is driven by the low hardship reported by people who live with their parents, 90% of whom are aged 30 or below. This may be because many are not involved in household financial matters. It could be argued, however, that this very fact constitutes avoidance of such hardship. It is not clear whether these particular indicators of hardship are reliable or relevant for those who live with their parents. In any case, these comparisons reveal that the age gradient is large across the whole population (not just coupled people), particularly when those who live with their parents are excluded. Our fixed-effects methodology necessitates the restriction to coupled people. However, we do show results from the full observed effects model (Model 4) for expanded populations (footnote 22).

are shared. Since younger couples have more dependents on average, this results in a further fall in the age effect by 0.003.[20]

Model 4 adds personality variables to the full set of controls used in Model 3. The sample is again the set of all couples in Waves 2 and 6, restricted further to those with valid responses to the personality questions in Wave 5. We find that openness to new experience and extroversion are associated with higher reported hardship, while conscientiousness has a negative effect. Interestingly, the effects of partner's personality are very similar to that of own personality.[21] Assuming one's partner's personality does not affect one's own reporting, we interpret this to suggest that personality characteristics operate as a resource rather than as a factor affecting reporting. With their inclusion, the age effect falls again to -0.0159. Overall, we find that observed resources and needs account for 61% of the raw age relationship.[22] However, age remains highly significant.

There is no statistically significant evidence in any of these models that the effects of the respondent's own characteristics differ from the effects of their partner's characteristics (either individually or jointly). Indeed for most significant variables (labour force status, education, personality) such effects are very similar. This is consistent with the theoretical model which suggests that household-level hardship is not determined by the respondent's own resources but that of the household. It also suggests that these variables are correlates of actual hardship rather than correlates of reporting error. Across each model, the age effects are almost completely unchanged when the coefficients of the respondent's characteristics are constrained to equal those of the spouse. The largest such change is 0.0002.

[20] We do not control for sex in any of the models. The respondent's sex does not affect household level resources or needs, since in the vast majority of cases each couple consists of one male and one female. Further, whilst reporting issues may feasibly be correlated with sex (and age may be correlated with sex in a sample of couples) we do not wish to hold such an effect constant in searching for evidence of any age related reporting differences. On a practical level, controlling for sex makes no substantive difference to the results.

[21] Wald tests find no evidence that the effects of own personality differ from that of partner's personality, either on individual indicators, or jointly.

[22] If singles living alone are also included in the samples for Models 1 & 4, observed resources and needs account for 65% of the raw age relationship. This percentage is unchanged (65%) when the sample is expanded further to include all respondents other than those living with their parents (though the assumption that bills are household-level expenditure items may be questionable for this broader population).

5.2 Fixed effects results for the household-level hardship index

The majority of the age relationship is explained by observed resources and needs. Nevertheless, 39% of the relationship is not yet accounted for. It may be related to unobserved differences between households. It may also result from age-specific reporting bias. The effect of reporting differences are isolated through couple-fixed effects models.

The results from the fixed effects Poisson regression are presented in Table 3, in which the coefficients are directly comparable to the cross-sectional Poisson results. As explained in Section 3, no control variables are required, and so age is the only explanatory variable (Model 5a). Model 5b illustrates the lack of sensitivity to the inclusion of such individual controls. Note that unlike most of the cross-sectional models, there is no need to restrict the analysis to the years in which net worth is available because it does not vary within couples.

The main result arising from this analysis is that age is not statistically significant in the fixed effects model. The point estimates for the age coefficient are also small. The estimated coefficient in Model 5a (-0.0035) suggests that a decrease in age of 40 years is associated with an increase in reported hardship by just 15% (and 2% in Model 5b). In addition to this, the estimates are precise enough to rule out any particularly large effects of age. For example, the 95% confidence interval for the age co-efficient in Model 5a is (-0.010, 0.003). The corresponding range for the effect of a forty year decrease in age is (-12%, 51%). Thus after controlling for unobserved heterogeneity we find no evidence to suggest that the number of reported hardship indicators is affected by age. Thus the raw age-hardship relationship is completely explained by observed resources and needs and unobserved household characteristics, rather than reporting differences.

Figure 3 summarizes the age effects in the three key models: Model 1, which demonstrates the effect of age without controlling for any other variables; Model 4, which represents the effect of age after controlling for all relevant observed characteristics; and Model 5a, which represents effect of age after controlling for couple-level fixed effects. The figure shows the predicted number of reported hardship indicators by age *relative* to that of a 75 year old, independent of other

observed characteristics.[23] Since the coefficient of age is a semi-elasticity, each series in this figure is a simple function of the estimated co-efficient and is independent of any covariates. The value on the vertical axis equals $\exp(\hat{\alpha} * (age - 75))$, where $\hat{\alpha}$ is the estimated coefficient of age in each model. The discussion of results, above, referred to the effects of a 40 year decrease in age. In Figure 3, those effects are represented by the value on the vertical axis for 35 year olds. As can be seen from the figure, the effect of age on the incidence of material hardship is reduced substantially after accounting for observed resources and needs, and it disappears completely after controlling for the couple-level fixed effects.

5.3 Results for individual indicators

The main measure of hardship used in the above analysis is the index constructed by summing thee three household-level binary indicators reported by each person.

We repeat all of the above analysis individually for each the seven hardship indicators. For the household-level indicators, we do this to verify the robustness of the results obtained using the cumulative indicator. We also seek to understand the determinants of the individual-level indicators.

Table 4 summaries the effects of age on the odds of reporting each indicator (odds ratios), in the key model specifications. The numbering of the models corresponds to the numbering in Tables 2 and 3. Model 1 refers to models without any control variables, while Model 4 refers to models with a full set of controls. Models 5a and 5b refer to fixed effects models with the same controls as discussed for the corresponding Poisson models. We report odds ratios rather than marginal effects since it is not possible to calculate marginal effects in the fixed effects logit model (Wooldridge 2002).

In Model 1, the effect of age is strong and statistically significant for each indicator. The effect of a single additional year of age decreases the *odds* of reporting each indicator by between 2.0% (unable to heat home) and 6.6% (sought help from friends/family).

For the household-level indicators, the results in Table 4 largely mirror those of the combined hardship analysis. In particular, much of the age effect is explained

[23] A 75 year old is chosen as a reference in order to demonstrate the estimated effects of age across a large proportion of the age distribution. Any other age could have been chosen.

by observed characteristics, and age is not significant in the fixed effects models. Thus the main results are not sensitive to the analysis of individual household-level indicators. For the 'unable to heat home', the age effect is completely explained by observed characteristics.

For the individual-level indicators, observed characteristics also explain some, but not all, of the respective age relationships. In each case, the age association remains statistically significant with the inclusion of the full set of control variables (Model 4). The results are less consistent across indicators in the fixed effects models. For the two 'sought financial help' questions, the age effect remains statistically significant (and reasonably large) in Model 5a. These two coefficients do not change substantially with the addition of individual controls (Model 5b), though the standard errors are larger. These findings are consistent with a number of possible explanations:

1) It may be that older people are more reluctant to ask for help in circumstances where others would.
2) Older people may have fewer people they can actually ask for help, or they may be less aware of the help that is available.
3) Older people might be less likely to report having asked for help in a survey context.
4) Older people may be less likely to recall having asked for help.
5) Finally, it could suggest that older people do not receive a fair share of resources within households.

Explanations 3), 4) and 5) seem unlikely, given the lack of a negative age effect in the other person-level indicators. Explanations 3) and 4) are also inconsistent with the lack of relationship in the fixed-effects models for the household-level indicators. Explanation 5) is also inconsistent with the lack of sensitivity to control variables (Model 5a and 5b). If resource sharing was unequal, one would expect the resulting age gradient to be reduced once controlling for individual contributions of resources to the household.

Explanations 1) and 2) are arguably consistent with the positive (point) estimates for the other two individual-level variables (one of which is also statistically significant in Model 5a). It may be that asking for assistance is a substitute for other forms of action. Instead of asking for assistance, perhaps older people's response to hardship is more likely to include skipping meals and selling items.

5.4 Further issues

In this sub-section, we address several issues which may be seen to threaten the validity of our approach.

Collusion

A potential limitation of the within-couple approach is the possibility that some couples completed the questions together. If so, the estimated coefficients may be biased downwards in the fixed effects models. The hardship questions are included in a self-completion questionnaire. The context in which that questionnaire is completed is not monitored or recorded. One way to gauge the extent of possible collusion is to consider the proportion of couples who responded to the hardship questions differently. In the sample used here, the number of reported hardship indicators differs between partners in 11.3% of all couple-years. For comparative purposes, it is useful to consider the corresponding discrepancy if responses were independent, conditional on observed characteristics. Using predicted values from the model with full controls (Model 4) under the further assumption that the count variable is conditionally Poisson distributed, this proportion is estimated to be 21.7%. Of course the assumption of conditional independence within couples is completely unrealistic since the responses are with respect to household level questions. Therefore, we are satisfied that any collusion between couples in answering the hardship questions is minor.

Do Age Effects Within Couples Reflect Age Effects in the Population?

We motivated our analysis with concerns over potential age-related reporting issues, stemming from correlations between age and cognitive and personality characteristics. A possible concern is that whilst such factors may be correlated with age, they may be uncorrelated with age *within* couples. *A priori*, this may occur for two reasons, i) that people choose partners that are similar to them (assortative mating) or ii) that they 'gravitate' to each other over time, due to shared stimuli. The general consensus in the psychology literature is that people do choose partners with broadly similar characteristics, but that they do not 'gravitate' (Keller et al. 1996). We confirm the lack of a gravitation effect in our results, by repeating the main analysis, stratifying the sample by length of time living together. We find no evidence of a

gravitation effect, as the residual age effects are very similar and not significant in the fixed effects Poisson models (Table 5).

Next, we consider the implications of assortative mating. Most studies have found positive correlations within couples for personality and cognitive characteristics (Keller et al. 1996; McCrae et al. 2008). We have no concern over the role of personality, since our analysis shows no impact of personality on reporting issues.[24] In any case, we control for the Big Five personality measures explicitly.

We are also unconcerned over assortative mating on cognitive skills. An inter-couple correlation does not in itself present a problem for our strategy. To repeat, it is the absence of a within-couple age gradient in cognitive ability that would be of concern. It is quite feasible for within-couple correlations in cognitive abilities to coexist with within-couple age gradients in cognitive ability. To put this another way, even if members of a couple have cognitive skills more similar to each other than to a random member of the population, the older member of the couple could still have poorer cognitive skills than the younger member on average. To test for such a within-couple age gradient in cognitive ability, one would regress cognitive ability on age, controlling for couple fixed effects. We know of no study that has examined this. Further, we know of no existing data set that would facilitate such an investigation. Papers in the assortative mating literature typically use samples of around 100-300 couple observations (see for instance Dufouil and Alpérovitch 2000; Gruber-Baldini and Willis 1995; Tambs et al. 1993).[25] Since the age variation within couples is usually small, such an investigation would require a much larger sample size to have reasonable statistical power. In any case, we believe there is good reason to anticipate a within-couple correlation between age and cognitive ability. In most domains, cognitive ageing has been found to be nonlinear, with faster decay in cognitive abilities at older ages (Baltes and Lindenberger 1997; Verhaeghen and Salthouse 1997). Even if people were to couple with spouses with exactly the same cognitive ability, a nonlinear path of cognitive ageing would ensure that this equality would not remain over time. Indeed if most couples were formed at relatively young ages, the within-couple age gradient in cognitive ability may closely resemble the age gradient in the population. In our data, most respondents began living with their current partner

[24] We find that personality operates as a resource rather an as a source of reporting (see Section 5).
[25] Some studies use larger samples, but none appear to have cognitive measures.

during early adulthood (prior to the age of 35 years in 87% of observations and before the age of 45 in 95% of observations).

A final risk is that social desirability bias is correlated with age across the population but not within couples. We do not have a strong sense of whether this is likely and can point to no relevant literature.

6 Conclusion

The strikingly large age gradient in self-reported hardship has major implications for social policy. We have attempted to identify the sources of this gradient. Whilst few economists have taken interest in these measures, we have attempted to situate our analysis within a theoretical framework that differentiates the roles of observed resources, latent behavioural choices and possible reporting bias. Our identification strategy has exploited a unique feature of the HILDA data, where both members of couples (who may differ in age) respond to the hardship questions. We have argued that this allows us to isolate the effect of reporting error.

We find that a majority (61%) of the age gradient is explained by age-differences in observed characteristics, particularly resources. Indeed two thirds of the gradient is explained by wealth and housing tenure, both of which heavily favour older people.

However, a substantial component (31%) of the gradient is explained by unobserved differences between households. We have argued that this is likely to reflect behavioural choices that vary with age. This finding needs to be interpreted with some care. Such behavioural choices may, in turn, reflect older people's greater experience with managing finances, an (unobserved) resource. On the other hand, past behavioural choices determine current resources. Thus the delineation between the components of the age gradient explained by resources and behavioural choices is not completely clean.

There is no evidence that age related reporting bias contributes to the gradient, despite considerable precision in our estimates stemming from a sample of almost 50,000 observations. This is encouraging for proponents of the hardship approach, as our analysis is a useful validation test.

There are a number of qualifications to be made and avenues for further research. A threat to internal validity is the possibility that social desirability bias is correlated with age in the population, but not within couples. It is unclear whether this is a major threat. There are of course threats to external validity. Our results are contingent on the context of the HILDA survey, including the mode of administration (self-completed questionnaire for the hardship questions), the order and placement of the questions in the instrument, as well as the content of the hardship questions themselves. It would be useful to conduct similar analyses in other countries, but this would require collecting data from both members of couples. It would also be useful to conduct such a study using other hardship indicators, since those available in HILDA are relatively limited. Our approach is readily applicable to other household-level indicators.

More fundamentally, the relationship between hardship and welfare has not been fully articulated in the literature. Our study suggests that behavioural choices are an important contributor to hardship. To the extent that these behaviours reflect rational preferences (over consumption, time and risk), it follows that hardship is not an indicator of welfare. The increasing interest of governments in hardship indicators warrants further research into the relationship between hardship and welfare.

Whilst the limitations of the study should be taken into account, these results suggest that older people in Australia suffer from much lower levels of hardship than younger people, with the level of hardship reducing steadily with age. The implication of this for the generosity of the age pension depends critically on the role of the pension. If its role is to prevent hardship, then it appears to be doing very well. This does not necessarily imply however, that the pension provides for an adequate standard of living, which is a normative issue.

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Table 1 Sample means

	Age group						
Variable	*20-29*	*30-39*	*40-49*	*50-59*	*60-69*	*70-79*	*All**
Hardship count (Household-level indicators) (0-3)	0.41	0.30	0.20	0.13	0.08	0.06	0.21
Hardship count (0-7)	0.84	0.56	0.35	0.22	0.13	0.09	0.39
Could not pay electricity gas or telephone bill on time	0.26	0.19	0.12	0.08	0.04	0.03	0.13
Could not pay mortgage/rent on time	0.13	0.09	0.06	0.03	0.02	0.02	0.06
Pawned or sole something	0.07	0.05	0.03	0.02	0.01	0.01	0.04
Went without meals	0.05	0.03	0.01	0.01	0.01	0.00	0.02
Was unable to heat the home	0.03	0.02	0.02	0.01	0.01	0.01	0.02
Sought financial help - friends/family	0.26	0.15	0.08	0.05	0.02	0.01	0.10
Sought financial help - welfare/community	0.05	0.03	0.02	0.02	0.01	0.01	0.02
Age	25.4	34.7	44.3	54.3	64.2	73.9	47.0
Female	0.58	0.53	0.50	0.49	0.47	0.42	0.50
Household income ($'000)	61.6	69.3	76.9	72.5	49.7	32.8	64.8
Personal income ($'000)	34.0	43.0	47.8	43.3	29.5	17.1	38.8
Own health (SF-36 scales; 0 (poor) to 100 (good))							
bodily pain	79.8	79.0	75.0	70.4	67.3	63.2	73.4
general heallth	73.6	74.1	70.7	67.4	64.2	61.8	69.4
mental health	74.4	75.2	74.6	76.0	77.4	77.9	75.5
physical functioning	91.7	91.2	87.6	81.1	74.6	64.1	83.6
role-emotional	87.0	87.7	87.3	85.5	84.1	77.7	85.4
role-physical	87.8	87.0	84.6	77.9	70.5	56.2	79.6
social functioning	85.4	86.2	85.2	83.6	83.1	78.8	84.1
vitality	60.3	60.7	60.7	61.4	62.7	59.3	60.7
Has a disability	0.11	0.12	0.16	0.26	0.37	0.48	0.22
Housing Tenure							
Outright owner	0.06	0.12	0.31	0.56	0.81	0.81	0.39
Buyer	0.39	0.60	0.54	0.31	0.08	0.02	0.38
Other (incl renter)	0.55	0.29	0.15	0.13	0.11	0.17	0.23
Household net worth ($'000)	189	407	668	911	1063	687	643
Labour force status							

employed	0.80	0.80	0.85	0.73	0.30	0.08	0.67
unemployed	0.04	0.02	0.02	0.02	0.01	0.00	0.02
Not in Labour Force	0.16	0.17	0.13	0.25	0.69	0.92	0.31
Weekly hours in paid work	31.3	30.8	33.6	28.7	9.5	1.2	25.6
Highest educational qualification							
Degree or higher	0.27	0.30	0.26	0.22	0.14	0.09	0.23
Diploma or certificate	0.32	0.33	0.35	0.32	0.33	0.30	0.32
Year 12	0.24	0.14	0.11	0.09	0.07	0.06	0.12
Year 11 or below	0.18	0.24	0.29	0.37	0.47	0.56	0.33
Remoteness							
Major City	0.63	0.63	0.60	0.57	0.54	0.58	0.60
Inner Regional	0.23	0.24	0.27	0.27	0.30	0.26	0.26
Outer Regional	0.12	0.11	0.12	0.13	0.14	0.14	0.12
Remote or Very Remote	0.02	0.03	0.02	0.03	0.02	0.02	0.02
Number of People in Household aged…							
0 to 4	0.48	0.69	0.17	0.03	0.01	0.00	0.27
5 to 9	0.14	0.56	0.39	0.05	0.01	0.00	0.25
10 to 14	0.03	0.36	0.65	0.13	0.02	0.00	0.27
15 and over	2.13	2.13	2.66	2.59	2.19	2.08	2.35
Number of People in HH with disability (excl self and partner)	0.06	0.15	0.15	0.08	0.05	0.02	0.10
Personality scales (1-7)							
extroversion	4.62	4.49	4.39	4.36	4.35	4.32	4.41
agreeableness	5.37	5.34	5.38	5.44	5.43	5.42	5.39
conscientiousness	5.08	5.14	5.16	5.25	5.36	5.40	5.21
emotional stability	5.04	5.07	5.13	5.33	5.50	5.64	5.24
openness to experience	4.19	4.21	4.24	4.18	4.08	3.86	4.16
Number of observations	5,492	11,157	11,714	8,797	6,140	3,646	48,089

Notes: The sample consists of coupled people, with non-missing household level hardship, see text. The unit of analysis is the person-year (HILDA Waves 1-7).

* includes 364 observations for coupled people aged under 20 and 779 observations for coupled people aged 80 or over

Table 2 Cross-sectional Poisson Regression Results

	Model 1		*Model 2a*		*Model 2b*		*Model 2c*		*Model 3*		*Model 4*	
Variable	*Co-efficient*	*SE*	*Co-efficient*	*SE*	*Co-efficient*	*SE*	*Co-efficient*	*SE*	*Co-efficient*	*SE*	*Co-efficient*	*SE*
age	-0.0405	0.0014***	-0.0471	0.0014***	-0.0194	0.0022***	-0.0216	0.0024***	-0.0189	0.0026***	-0.0159	0.0033***
Household income ($'000s)			-0.0149	0.0010***	-0.0105	0.0017***	-0.0103	0.0018***	-0.0152	0.0018***	-0.0142	0.0021***
Household income squared			0.0000	0.0000***	0.0000	0.0000***	0.0000	0.0000***	0.0000	0.0000***	0.0000	0.0000**
own labour force status												
unemployed			0.3987	0.0778***	0.2878	0.1227*	0.1544	0.1253	0.2099	0.1245	0.1693	0.1558
nilf			0.0761	0.0643	-0.0098	0.0982	-0.1637	0.0978	-0.1684	0.0926	-0.2016	0.1097
partner's labour force status												
unemployed			0.3552	0.0776***	0.3370	0.1201**	0.1928	0.1245	0.2332	0.1245	0.1130	0.1524
nilf			0.1056	0.0630	0.0698	0.0984	-0.0254	0.1015	-0.0384	0.0959	-0.1674	0.1108
hours worked			-0.0012	0.0015	-0.0025	0.0022	-0.0013	0.0021	0.0008	0.0020	0.0012	0.0024
partner's hours worked			-0.0015	0.0014	0.0007	0.0021	0.0015	0.0021	0.0034	0.0020	0.0014	0.0023
own education												
bachelor or higher			-0.4129	0.0668***	-0.3072	0.0850***	-0.3069	0.0855***	-0.2222	0.0868*	-0.3560	0.1036**
diploma or certificate			-0.0512	0.0450	-0.0153	0.0578	-0.0429	0.0595	-0.0168	0.0596	-0.1235	0.0733
completed year 12			-0.1704	0.0579**	-0.1213	0.0722	-0.1446	0.0759	-0.1016	0.0766	-0.2109	0.0930*
partner's education												
bachelor or higher			-0.4013	0.0665***	-0.2858	0.0829**	-0.2754	0.0850**	-0.1905	0.0860*	-0.2633	0.1058*
diploma or certificate			-0.0756	0.0449	-0.0219	0.0575	-0.0430	0.0597	-0.0190	0.0600	0.0111	0.0747
completed year 12			-0.1945	0.0592**	-0.1233	0.0728	-0.1108	0.0749	-0.0716	0.0748	-0.0951	0.0903
housing tenure												
outright owner					-1.0702	0.1001***	-1.0443	0.1031***	-0.9933	0.1030***	-1.0324	0.1253***
purchaser					-0.2989	0.0558***	-0.2439	0.0572***	-0.2952	0.0573***	-0.3454	0.0687***
net worth					-0.1001	0.0151***	-0.0874	0.0149***	-0.0886	0.0150***	-0.0878	0.0184***
net worth squared					0.0008	0.0001***	0.0007	0.0001***	0.0007	0.0001***	0.0007	0.0001***
own disability							-0.0202	0.0675	-0.0032	0.0670	0.0156	0.0796
partner's disability							0.0494	0.0676	0.0697	0.0677	-0.0566	0.0827
own health (SF-36)												
bodily pain							-0.0019	0.0014	-0.0019	0.0014	-0.0030	0.0017
general heallth							-0.0029	0.0016	-0.0034	0.0016*	-0.0021	0.0020
mental health							-0.0045	0.0019*	-0.0051	0.0020**	-0.0019	0.0025
physical functioning							0.0024	0.0015	0.0022	0.0015	0.0020	0.0019
role-emotional							-0.0027	0.0009**	-0.0027	0.0009**	-0.0020	0.0010
role-physical							-0.0016	0.0009	-0.0018	0.0009	-0.0012	0.0011

social functioning							-0.0011	0.0015	-0.0010	0.0015	-0.0012	0.0019
vitality							-0.0033	0.0018	-0.0021	0.0018	-0.0044	0.0022*
partner's health (SF-36)												
bodily pain							-0.0001	0.0014	-0.0003	0.0013	-0.0003	0.0017
general heallth							-0.0029	0.0015	-0.0035	0.0015*	-0.0054	0.0019**
mental health							-0.0027	0.0020	-0.0032	0.0020	-0.0031	0.0026
physical functioning							0.0025	0.0016	0.0025	0.0015	0.0038	0.0020
role-emotional							-0.0014	0.0009	-0.0014	0.0009	-0.0003	0.0011
role-physical							-0.0011	0.0010	-0.0013	0.0010	-0.0020	0.0011
social functioning							-0.0025	0.0016	-0.0023	0.0016	-0.0033	0.0019
vitality							-0.0001	0.0018	0.0011	0.0018	0.0015	0.0023
Remoteness												
Inner Regional									-0.0063	0.0559	-0.0199	0.0677
Outer Regional									-0.0415	0.0707	-0.0916	0.0858
Remote or Very Remote									-0.3801	0.2147	-0.2149	0.3030
Number of People in Household aged												
0 to 4									0.2081	0.0335***	0.2251	0.0398***
5 to 9									0.1838	0.0343***	0.1560	0.0430***
10 to 14									0.1204	0.0340***	0.1608	0.0394***
15 and over									0.2526	0.0348***	0.2688	0.0452***
N of Pple in HH with disbity (ex coupl)									0.0294	0.0435	-0.0529	0.0550
Own Personality												
extroversion											0.0836	0.0290**
agreeableness											0.0693	0.0375
conscientiousness											-0.1321	0.0313***
emotional stability											-0.0498	0.0302
openness to experience											0.0870	0.0316**
Partner's Personality												
extroversion											0.1040	0.0292***
agreeableness											0.0741	0.0366*
conscientiousness											-0.1507	0.0328***
emotional stability											-0.0141	0.0313
openness to experience											0.0630	0.0314*
constant	0.1599	0.0583**	1.4416	0.1082***	0.6663	0.1657***	2.3857	0.2429***	1.6155	0.2571***	0.9776	0.4415*
Sample size	48,089		46,761		12,967		11,721		11,721		9,226	

Notes: The sample consists of coupled people, with further restrictions as detailed in the text. The unit of analysis is the person-year. The dependent variable in each model is defined as the sum of three binary household level hardship indicators, see text.

*** significant at p<0.001; ** p<0.01; * p<0.05

Table 3 Fixed Effects 'Within Couple' Poisson Regression Results

	Model 5a		*Model 5b*	
Variable	*Co-efficient*	*SE*	*Co-efficient*	*SE*
age	-0.0035	0.0035	-0.0006	0.0046
labour force status				
unemployed			0.0167	0.0822
nilf			-0.1106	0.0602
hours worked			0.0004	0.0014
education				
bachelor or higher			-0.0830	0.0720
diploma or certificate			-0.0609	0.0454
completed year 12			0.0173	0.0637
personal income $'000s			-0.0010	0.0012
personal income squared			0.0000	0.0000
disability			-0.0717	0.0480
health (SF-36)				
bodily pain			-0.0028	0.0009**
general heallth			0.0028	0.0013*
mental health			-0.0037	0.0016*
physical functioning			-0.0014	0.0011
role-emotional			-0.0009	0.0006
role-physical			0.0007	0.0006
social functioning			-0.0012	0.0010
vitality			-0.0029	0.0014*
Personality				
extroversion			-0.0042	0.0167
agreeableness			0.0339	0.0246
conscientiousness			-0.0028	0.0185
emotional stability			-0.0124	0.0210
openness to experience			-0.0064	0.0218
Sample Size	48089		37791	

Notes: The sample consists of coupled people, with further restrictions as detailed in the text. The unit of analysis is the person-year. The dependent variable in each model is defined as the sum of three binary household level hardship indicators, see text.
*** significant at p<0.001; ** p<0.01; * p<0.05

Table 4 Estimated Age Odds-Ratios from Logit Regressions for Individual Hardship Indicators

Dependent Variable	*Model 1*		*Model 4*		*Model 5a*		*Model 5b*	
	Odds ratio	*SE*	*Odds ratio*	*SE*	*Odds ratio*	*SE*	*Odds ratio*	*SE*
Household Level Indicators								
Could not pay electricty gas or telephone on time	0.9551	0.0016***	0.9778	0.0044***	0.9845	0.0091	0.9828	0.0125
Could not pay mortgage/rent on time	0.9568	0.0020***	0.9756	0.0058***	1.0048	0.0111	1.0273	0.0164
Was unable to heat the home	0.9797	0.0038***	1.0087	0.0098	0.9974	0.0178	1.0068	0.0302
Individual Level Indicators								
Pawned or sold something	0.9554	0.0025***	0.9779	0.0069**	1.0290	0.0140*	1.0152	0.0176
Went without meals	0.9486	0.0040***	0.9602	0.0104***	1.0120	0.0176	1.0141	0.0232
Sought financial help - friends/family	0.9344	0.0019***	0.9420	0.0051***	0.9733	0.0098**	0.9676	0.0137*
Sought financial help - welfare/community	0.9637	0.0034***	0.9813	0.0093*	0.9692	0.0151*	0.9755	0.0181

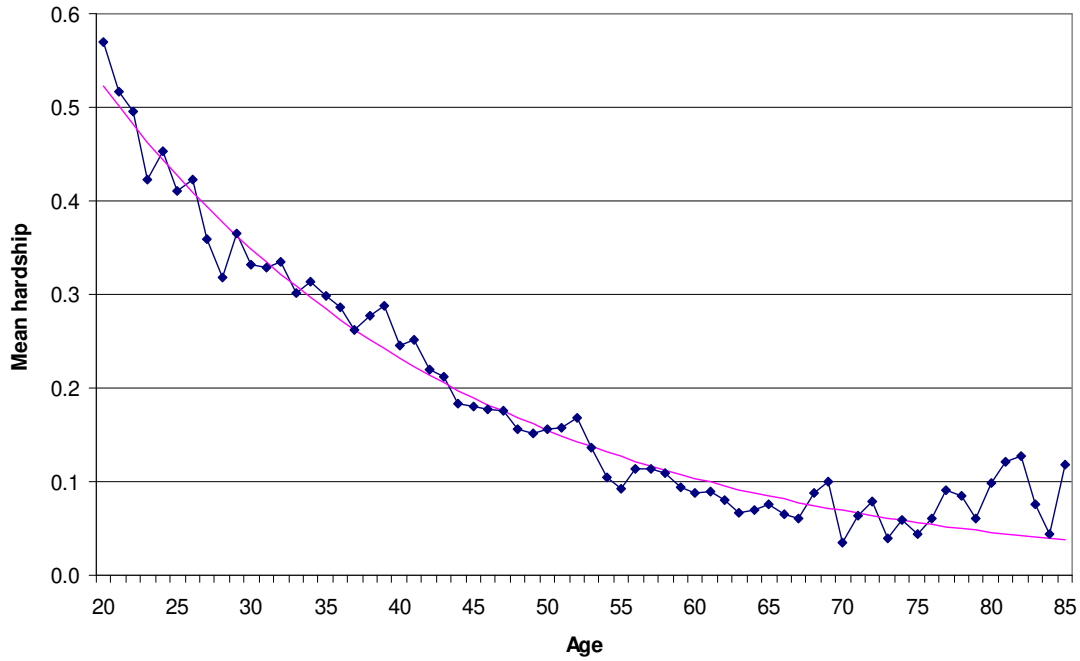
Notes: The sample consists of coupled people, with further restrictions as detailed in the text. The unit of analysis is a person-year. The dependent variable in each model is a binary hardship indicator, see text.
Odds ratio is significantly different from one at *** p<0.001; ** p<0.01; * p<0.05

Table 5 Fixed Effects 'Within Couple' Poisson Regression Results, Sample Stratified by Time Living Together

	Model 5a	
Subpopulations	*Co-efficient*	*SE*
lived together for less than 10 years	-0.0040	0.0042
lived together for less than 5 years	-0.0018	0.0050
lived together for at least 10 years	-0.0031	0.0061

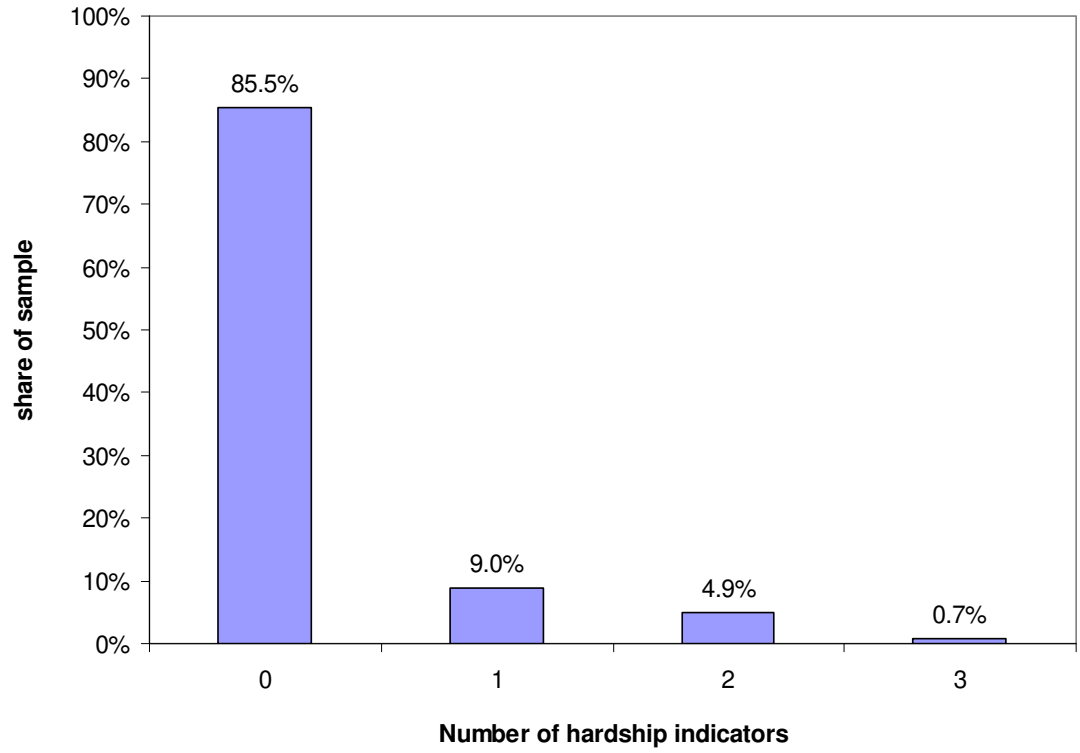
Notes: The sample consists of coupled people, with further restrictions as detailed in the text. The unit of analysis is a person-year. The dependent variable in each model is defined as the sum of three binary household level hardship indicators, see text.

Figure 1 Mean Number of Household-Level Hardship Indicators Reported by Age



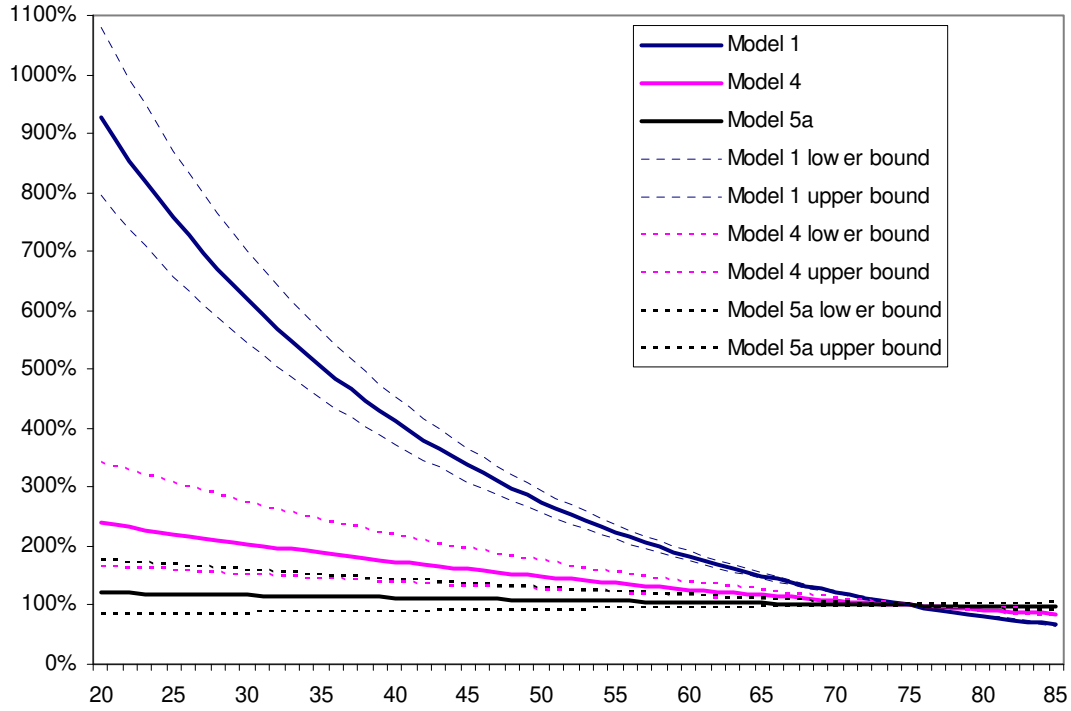
Note: The sample consists of coupled people, as detailed in the text. The unit of analysis is the person-year. The dependent variable is defined as the sum of three binary household level hardship indicators, see text.

Figure 2 Distribution of Number of Household-Level Hardship Indicators Reported



Notes: The sample consists of coupled people, as detailed in the text. The unit of analysis is the person-year. The variable being analysed is defined as the sum of three binary household level hardship indicators and is hence restricted to the integers ranging from 0 to 3, inclusive.

Figure 3 Estimated Effect of Age on Reported Household-Level Hardship (Index=100% for age=75 years), Selected Models



Notes: This figure summarises the estimated effects of age on household level hardship from the three key Poisson regression models, as reported in detail in Tables 2 and 3. Model 1 summarises the age gradient, without controlling for any other variables. Model 4 represents the effect of age after controlling for all relevant observed characteristics. Model 5a represents effect of age after controlling for couple-level fixed effects. The figure shows the predicted number of reported hardship indicators by age *relative* to that of a 75 year old. Since the coefficient of age in the Poisson models is a semi-elasticity, each series in this figure is a simple function of the estimated co-efficient and is independent of any covariates. The value on the vertical axis equals $\exp\left(\hat{\alpha} * (age - 75)\right)$, where $\hat{\alpha}$, is the estimated coefficient of age in each Poisson model, with 95% CIs.