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IS THE AGE GRADIENT IN SELF-REPORTED MATERIAL HARDSHIP EXPLAINED BY RESOURCES, NEEDS, BEHAVIORS, OR REPORTING BIAS?

by Peter Siminski* and Oleg Yerokhin

University of Wollongong

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 this age 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 and Labour Dynamics Australia (HILDA) survey, which collects reports of hardship from all adult household members. This facilitates within-couple estimates, allowing us to identify age-related reporting bias. The majority of the raw age–hardship gradient 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 behavioral choices. Reporting error does not appear to contribute to the age gradient.

JEL Codes: I32, J14, D63, D39

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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). According to Berthoud and Bryan (2008, p. 14), "indica-

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*Correspondence to: Peter Matthew Siminski, School of Economics, University of Wollongong, Northfields Ave., Wollongong, NSW 2522, Australia (siminski@uow.edu.au).

tors 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." This appears to be the case at least 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 and 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 (Travers and Robertson, 1996; Bray, 2001; McColl *et al*., 2001; Headey, 2005; Saunders and Naidoo, 2009). In other countries, hardship questions are also present in large nationally representative surveys such as the Survey of Income and Program Participation (USA) and the German Socio-Economic Panel. The rise of these indicators is consistent with the now consensus view of poverty and wellbeing as multidimensional concepts, measurable only through a suite of indicators (Stiglitz *et al*., 2009; Alkire and Foster, 2011).

Despite the interest in the policy realm and in other disciplines, very few papers have addressed material hardship in the mainstream economics literature. The leading exception is Mayer and Jencks (1989), who conducted a survey of Chicago residents, asking respondents about the incidence of hardship, including inability to pay rent and utilities bills due to a shortage of money. They focused on why income did not 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 the material hardship construct (some further exceptions are Saunders and Bradbury, 2006; Breunig *et al*., 2007; Iceland and Bauman, 2007; Saunders and Naidoo, 2009). There are several good explanations for this. First, economists are traditionally suspicious of the reliability of self-reports. There is also ambiguity over the roles of resources and behavioral choices in determining the presence of a particular form of hardship. Thus the absence of hardship is not synonymous with economic welfare. We come some way toward addressing these issues. Our theoretical framework explicitly accounts for the role of observed resources, needs, and latent behavioral choices, and the presence of non-ignorable reporting issues in self-reported hardship.[1] 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

[1]For a given set of resources and needs, we see hardship also being determined by the respondent's behavior. These "behavioral choices" may reflect both rational preferences (over risk, time, forms of consumption) and mistakes or biases in judgment. These issues are discussed further in Sections 2 and 3.

data, coupled people aged in their 20s reported seven times more hardship than those in their 70s, despite having almost twice their average income. Using similar data, Saunders and 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 and 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." (Other studies which find an age-gradient across a range of indicators and countries include Lollivier and Verger, 1997; Mirowsky and Ross, 1999a, 1999b; Bray, 2001; Headey, 2005; Berthoud *et al.*, 2006; Marks, 2007; 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 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, behavioral 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 the aims of this paper. 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), behavioral choices, and reporting bias. Little attention has been placed in the existing literature on explaining the age gradient.[2] 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.[3] We argue that for household-level hardship indicators, an

[2]Using panel data, Berthoud *et al.* (2006, 2009) attempted to unpick cross-sectional age differences in reported hardship by distinguishing between ageing effects and cohort differences. They did not seek to decompose the effects of resources, behavioral choices, and reporting.

[3]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 dependant children, are sufficiently aware of the household's circumstances to reliably address these questions. For related analyses of self-reporting differences within couple households, see Breunig *et al.* (2007) and Plug and Van Praag (1998).

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.

To implement this approach, we focus on three self-reported household level hardship indicators: inability to pay electricity, gas, or telephone bills on time; inability to pay mortgage or rent on time; and inability to heat home (all due to a shortage of money). 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 behavioral choices. We find no evidence 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 organized 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. Section 6 addresses threats to validity in some detail, while Section 7 concludes with recommendations to researchers and policy makers.

2. The Complex Relationship Between Self-Reported Hardship and Age

There is considerable evidence that low income and hardship approaches produce drastically different results when analyzing age differences in the prevalence of disadvantage. 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 (Mayer and Jencks, 1989; Lollivier and Verger, 1997; Mirowsky and Ross, 1999a, 1999b; Bray, 2001; Headey, 2005; Berthoud *et al*., 2006; Saunders and Bradbury, 2006; Marks, 2007; 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, differences in needs, or a reflection of behavioral choices that are correlated with age? We discuss reporting error and "behavioral choices" in turn, below.

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. To answer a single question requires interpreting the question, retrieving 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 (Schwarz, 2007). It is well established that the cognitive faculties associated with survey response decline with age (Verhaeghen and Salthouse, 1997; Schwarz *et al*., 1998). 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" (Schwarz, 2003, p. 590). Further to this, 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 (Siminski, 2008). But this literature does not yield a clear prediction about even the direction of any resulting age-related reporting bias for the present analysis.

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 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 behaviors across a range of surveys and modes of administration (Gove and Geerken, 1977; Lewinsohn *et al.*, 1993; Holbrook *et al.*, 2003). Some qualitative evidence shows that older people are reluctant to admit to needing help when in need (Moen, 1977–78; Dominy and Kempson, 2006). Related to this, whilst older people do report the absence of various necessities, they are much less likely to attribute this to a shortage of money (McKay, 2004; Berthoud *et al.*, 2006; Dominy and Kempson, 2006). 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.[4] The extent to which 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 from such bias (Bradburn *et al.*, 2004, p. 100). In any case, our identification strategy arguably accounts for social desirability bias.

[4]In the studies referred to (McKay, 2004; Berthoud *et al.*, 2006; 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 focused 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 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 datasets. 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.

As noted in footnote 1, behavioral choices might reflect rational decisions on how to allocate limited financial resources among various needs. For example, a household might decide to cut back on heating expenditures in order to increase the amount of money available for other forms of consumption. In this case policy makers may be more concerned about hardship caused by a shortage of resources than hardship due to rational behavioral choices.[5] On the other hand, observed differences in hardship might be caused by mistakes or biases in judgment. A poor choice of electricity or telephone billing plan may result in problems paying bills on time. Excessive use of electricity or a telephone due to poor financial planning or self control problems may have a similar effect. There is now a large literature on biases which impact on people's behavioral choices. This literature is associated with a new set of policy responses which have been referred to as "libertarian paternalism." For example, such policies include setting carefully considered "default options" for insurance plans and retirement saving plans (e.g. Beshears *et al.*, 2008). In the present context, to the extent that hardship is caused by behavioral biases, an appropriate policy response could involve analogous "default options" for electricity, gas, water, and telephone billing plans. While in the present context distinguishing empirically between rational responses and mistakes remains a difficult task, in principle this could be achieved by combing reasonable assumptions about preferences and mistakes with observed data (Köszegi and Rabin, 2008).

There are thus 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 and Empirical Strategy

We consider household-level material hardship indicators.[6] Assume that for a given household j, *actual* material hardship (M^*) in a given time period t is a function of household resources (R), "needs" (N), and behavioral choices (B^*).

$$M^*_{jt} = f(R_{jt}, N_{jt}, B^*_{jt}). \tag{1}$$

Actual hardship and behavioral choices are not directly observed, indicated by the asterisks (*). 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.

Within couples, individual members may differ in their command of resources, and may exhibit different behavioral choices. A crucial aspect of the

[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.

[6]As 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.

identification strategy is that household-level hardship depends only on an aggregation of resources and behavioral choices within the household. This is a testable proposition as it implies that the effects of a respondent's own characteristics should be the same as the effects of their spouse's characteristics. We find strong support for this proposition.

Resources include financial resources (income, wealth, etc.), human capital (education and health), and non-market time available for domestic production. Resources partly reflect behavioral 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,[7] 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, behavioral choices are a determinant of resources. There is also a direct role for behavioral choices in the model. For a given set of resources and needs, the presence of hardship depends on behavioral choices. An individual's behavior may reflect rational preferences over consumption, time, and risk. It may also reflect mistakes or biases in judgment, for instance due to a lack of experience with finances.

Age has no direct role in (1). 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.[8] 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 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.

$$M_{ijt} = g(A_{ijt}, M^*_{jt}). \tag{2}$$

The relationship between reported hardship and its identifiable determinants (which do not include behavioral choices B^*, since these are not observed) is:

$$M_{ijt} = h(A_{ijt}, R_{jt}, N_{jt}, \theta_{jt}). \tag{3}$$

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

[8]Cognitive ability may be correlated with mental health status indicators. Therefore, health control variables may *a priori* 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.

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

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

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

The parameter α_1 represents the size of the raw relationship. Its interpretation varies with the empirical specification, to be discussed in Section 4. We then re-estimate the model with the addition of controls for resources:

$$M_{ijt} = h_2(A_{ijt}, R_{jt}; \alpha_2, \beta_2). \tag{5}$$

The parameter α_2 represents the size of the age relationship after controlling for resources; 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.[9] Next, we add controls for needs:

$$M_{ijt} = h_3(A_{ijt}, R_{jt}, N_{jt}; \alpha_3, \beta_3, \gamma_3). \tag{6}$$

γ_3 is the vector of coefficients of N. Similarly to above, the parameter α_3 represents the size of the age effect 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 couple-year fixed effects:

$$M_{ijt} = h_4(A_{ijt}, \theta_{jt}; \alpha_4). \tag{7}$$

In (7), θ accounts for all factors common to members of a couple at a point in time.[10] The parameter α_4 represents the effect of age within couples at a point in time, thus 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.[11] In particular, this includes age-related differences between households in behavioral choices. Finally, α_4 can be interpreted as the component of the age effect that is explained by age-related reporting differences.

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

[10]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, labor 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.

[11]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.

4. Data and Methods

4.1. *Sample Construction*

The data used in this paper are from the Household, Income and Labour Dynamics in Australia (HILDA) survey, 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 consists of 19,914 individuals in 7682 households. We utilize the confidentialized unit records for Waves 1–7 (release 7.0). Since the identification strategy exploits intra-household variation in 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 those with missing household-level hardship indicators, we are left with 48,089 observations.[12]

We focus on responses to three 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*: "could not pay electricity, gas, or telephone bills on time," "could not pay mortgage or rent on time," or "was unable to heat home." We regard these three as household-level indicators.[13] We construct a cumulative index of household-level hardship by summing these three binary indicators for each respondent. This is the dependent variable in most of the analysis. A simple count is justified with reference to Butterworth and Crosier (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 analyzing 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.[14] Each scale ranges from 0 (worst possible score) to 100 (best possible), representing

[12]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, since the sample is necessarily restricted to specific waves (Waves 2 and 6). Given the pooled cross-sectional nature of the analysis, such sample restrictions are not associated with any substantive risk of sample selection bias.

[13]In the questionnaire, these questions are accompanied by four other indicators, which we regard as individual level indicators. We ignore such indicators, since the identification strategy outlined in Section 3 is not credible for individual-level indicators. We note that the size of the age gradient for the indicators we have used is similar to that of the other indicators in HILDA (see our Working Paper: Siminski and Yerokhin, 2010, table 1). Evidence from other countries also suggests that the size of the age gradient for such indicators is not remarkable in comparison to other indicators (see Mirowsky and Ross, 1999b, table 1; Berthoud *et al*., 2006, figure 2.5).

[14]The SF-36 scales are provided on the HILDA file. The SF-36 data consist of self-reports to 36 questions. Each of the eight summary scales is an aggregation of between two and ten of these 36 items, rescaled to range from a minimum of zero to a maximum of 100. Each item is used in the derivation of only one of the eight scales. For a detailed explanation of SF-36 and the algorithm for deriving the subscales, see Ware *et al*. (2000). For evidence of favorable psychometric properties of SF-36 in HILDA, see Butterworth and Crosier (2004).

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 cannot be corrected by medication or medical aids.

Other included "resource" variables are household income, net worth, and housing tenure; and for both members of the couple: education, labor force status, and weekly hours in paid work.[15] 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 the person's attitude toward life circumstances. Thus personality attributes may be "resources," but they may also capture response 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 household-level hardship indicators reported was 0.21. The most frequently reported indicator was "could not pay electricity, gas, or telephone bills on time" (0.13), followed by "could not pay mortgage/rent on time" (0.06).[16] There is a strong and consistent negative association between age and reported hardship. On average, respondents aged 20–29 (20s) reported seven times more hardship indicators than those aged 70–79 (70s). For each age group, the mean number of hardship indicators reported was less than that of each younger age group. This age relationship also exists for all four individual level hardship indicators (Siminski and Yerokhin, 2010). Figure 1 displays this comparison in more detail, reporting the mean number of

[15]Hours in paid work accounts for time available for household production. Labor force status is treated as a resource since employment can provide non-pecuniary benefits through social networks and other workplace resources. Labor 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 labor force.

[16]This question is asked of all respondents, regardless of housing tenure. *A priori*, it is conceivable that outright home owners may have a greater rate of missing data for this question, but this is not the case. Their rate of missing data for this question is low (7 percent), which is no higher than other respondents. Few (less than 2 percent) of outright home owners report experiencing this form of hardship. That any of them report such hardship may be surprising. But this may be due to mortgage/rent payments on secondary properties, or conceivably it may be due to changes in housing tenure over the recall period for this question.

TABLE 1

Sample Means

Variable	Age Group						
	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
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
Was unable to heat the home	0.03	0.02	0.02	0.01	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 health	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	1,063	687	643
Labor 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 labor 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 household 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. 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.

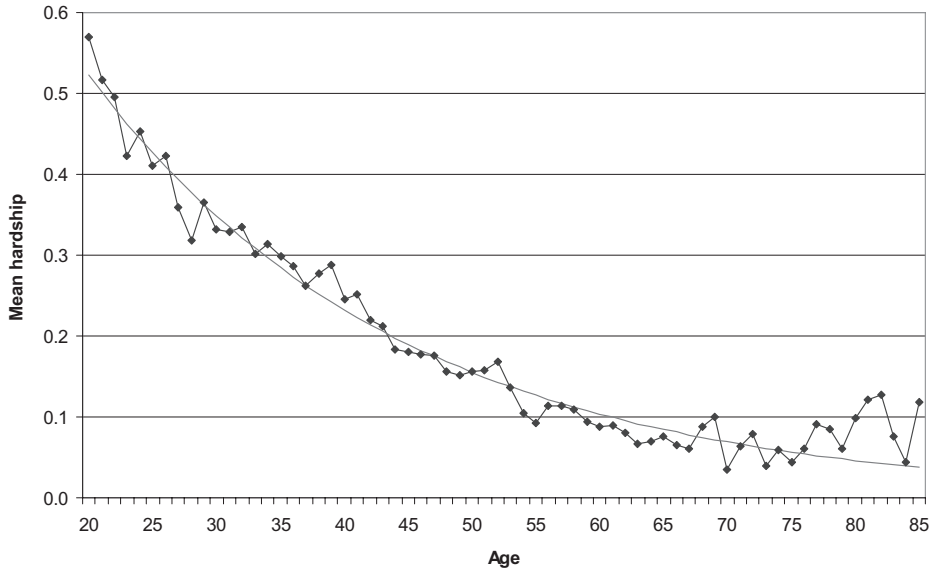

Figure 1. Mean Number of Household-Level Hardship Indicators Reported by Age

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.

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 right-skewed, 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.

Despite reporting less hardship, older people have a number of characteristics that should 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 four 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 three times less than amongst 30s, and the proportion of 70s who did not complete year 12 is three times higher than amongst 20s.

On the other hand, older people have several characteristics which should be associated with lower incidence of hardship. Older people have much higher rates of home ownership. More than 80 percent of 70s are outright home owners, compared to 6 percent of 20s. Partly reflecting this, older people also have higher net worth. Mean household net worth peaks at $1.06m for 60s. Even though it falls

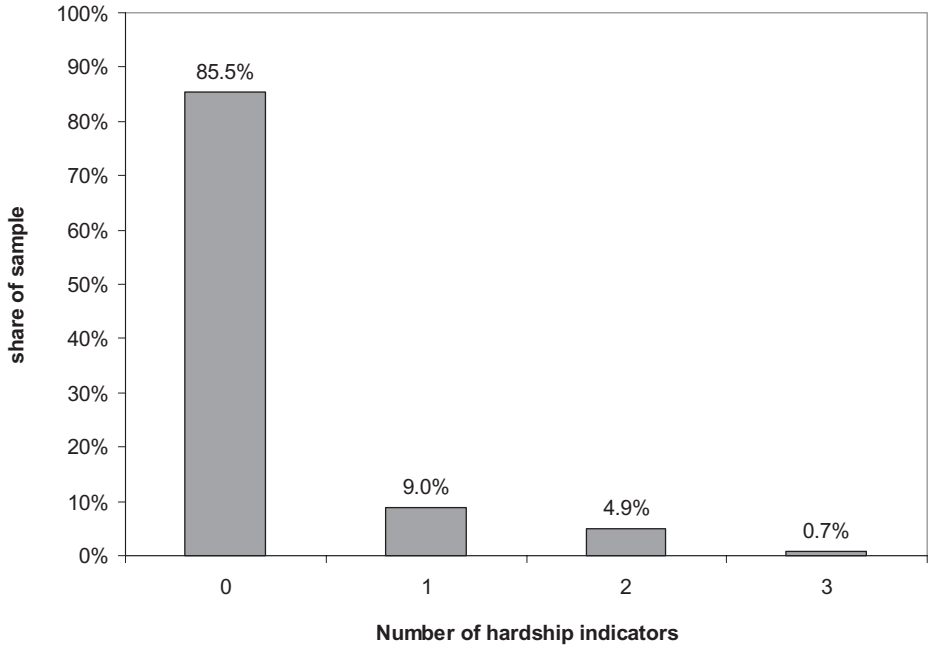

Figure 2. Distribution of Number of Household-Level Hardship Indicators Reported

Notes: The sample consists of coupled people, as detailed in the text. The unit of analysis is the person-year. The variable being analyzed 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.

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 percent 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]

$$E(M_{ijt}|x_{ijt}) = \exp(x_{ijt}\beta). \tag{8}$$

[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. The results are qualitatively unchanged when linear models are used instead of Poisson models.

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-year 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 at time t is assumed to have Poisson distribution with conditional mean function given by:

$$E(M_{ijt}|c_{jt}, x_{ijt}) = c_{jt} \exp(x_{ijt}\beta), \tag{9}$$

where c_{jt} is the multiplicative fixed effect.

In robustness tests, we also analyze the binary indicators individually, using cross-sectional and couple-year fixed effects logit models.

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 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 coefficient suggests that an increase in age by a single year is associated with approximately 4 percent less reported hardship.[18] 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 percent. This increase in the age parameter is driven by income and education,

[18]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 three years and –0.041 when restricted to the last three years. The difference between the two is not statistically significant. 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 percent 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 (see footnote 21).

TABLE 2

CROSS-SECTIONAL POISSON REGRESSION RESULTS

	Model 1		Model 2a		Model 2b		Model 2c		Model 3		Model 4	
Variable	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Age	−0.0405	0.0018***	−0.0471	0.0017***	−0.0194	0.0026***	−0.0216	0.0029***	−0.0189	0.0031***	−0.0159	0.0040***
Household income ($'000)			−0.0149	0.0012***	−0.0105	0.0021***	−0.0103	0.0021***	−0.0152	0.0022***	−0.0142	0.0026***
Household income squared			0.0000	0.0000***	0.0000	0.0000***	0.0000	0.0000***	0.0000	0.0000***	0.0000	0.0000*
Own labor force status												
Unemployed			0.3987	0.0777***	0.2878	0.1188*	0.1544	0.1198	0.2099	0.1195	0.1693	0.1514
Not in labor force			0.0761	0.0631	−0.0098	0.0963	−0.1637	0.0952	−0.1684	0.0902	−0.2016	0.1043
Partner's labor force status												
Unemployed			0.3552	0.0781***	0.3370	0.1152**	0.1928	0.1179	0.2332	0.1185*	0.1130	0.1487
Not in labor force			0.1056	0.0619	0.0698	0.0964	−0.0254	0.0990	−0.0384	0.0935	−0.1674	0.1047
Hours worked			−0.0012	0.0015	−0.0025	0.0022	−0.0013	0.0022	0.0008	0.0020	0.0012	0.0023
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	0.0597***	−0.3072	0.0786***	−0.3069	0.0792***	−0.2222	0.0804**	−0.3560	0.0993***
Diploma or certificate			−0.0512	0.0432	−0.0153	0.0580	−0.0429	0.0591	−0.0168	0.0588	−0.1235	0.0735
Completed year 12			−0.1704	0.0550**	−0.1213	0.0707	−0.1446	0.0749	−0.1016	0.0758	−0.2109	0.0915*
Partner's education												
Bachelor or higher			−0.4013	0.0599***	−0.2858	0.0764***	−0.2754	0.0786***	−0.1905	0.0797*	−0.2633	0.1018*
Diploma or certificate			−0.0756	0.0430	−0.0219	0.0574	−0.0430	0.0593	−0.0190	0.0592	0.0111	0.0745
Completed year 12			−0.1945	0.0564**	−0.1233	0.0714	−0.1108	0.0741	−0.0716	0.0742	−0.0951	0.0886
Housing tenure												
Outright owner					−1.0702	0.1195***	−1.0443	0.1222***	−0.9933	0.1220***	−1.0324	0.1505***
Purchaser					−0.2989	0.0681***	−0.2439	0.0702***	−0.2952	0.0701***	−0.3454	0.0845***
Net worth					−0.1001	0.0180***	−0.0874	0.0179***	−0.0886	0.0180***	−0.0878	0.0229***
Net worth squared					0.0008	0.0001***	0.0007	0.0001***	0.0007	0.0001***	0.0007	0.0002***
Own disability							−0.0202	0.0626	−0.0032	0.0627	0.0156	0.0751
Partner's disability							0.0494	0.0631	0.0697	0.0640	−0.0566	0.0792
Own health (SF-36)												
Bodily pain							−0.0019	0.0014	−0.0019	0.0014	−0.0030	0.0017
General health							−0.0029	0.0016	−0.0034	0.0016*	−0.0021	0.0020
Mental health							−0.0045	0.0019*	−0.0051	0.0019**	−0.0019	0.0025
Physical functioning							0.0024	0.0015	0.0022	0.0014	0.0020	0.0019
Role–emotional							−0.0027	0.0008**	−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	0.0016	−0.0012	0.0019
Vitality							−0.0033	0.0018	−0.0021	0.0018	−0.0044	0.0022*

Table 2 continued on next page

TABLE 2 (*continued*)

Variable	Model 1		Model 2a		Model 2b		Model 2c		Model 3		Model 4	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Partner's health (SF-36)												
Bodily pain							–0.0001	0.0014	–0.0003	0.0014	–0.0003	0.0017
General health							–0.0029	0.0015	–0.0035	0.0015*	–0.0054	0.0019**
Mental health							–0.0027	0.0020	–0.0032	0.0020	–0.0031	0.0025
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	0.0018
Vitality							–0.0001	0.0018	0.0011	0.0018	0.0015	0.0023
Remoteness												
Inner regional									–0.0063	0.0681	–0.0199	0.0832
Outer regional									–0.0415	0.0843	–0.0916	0.1023
Remote or very remote									–0.3801	0.2160	–0.2149	0.3001
Number of people in household aged . . .												
0 to 4									0.2081	0.0408***	0.2251	0.0482***
5 to 9									0.1838	0.0418***	0.1560	0.0531**
10 to 14									0.1204	0.0409**	0.1608	0.0475***
15 and over									0.2526	0.0428***	0.2688	0.0572***
Number of people in household with disability (excl. self and partner)									0.0294	0.0534	–0.0529	0.0678
Own personality												
Extroversion											0.0836	0.0296**
Agreeableness											0.0693	0.0382
Conscientiousness											–0.1321	0.0303***
Emotional stability											–0.0498	0.0295
Openness to experience											0.0870	0.0312**
Partner's personality												
Extroversion											0.1040	0.0297***
Agreeableness											0.0741	0.0373*
Conscientiousness											–0.1507	0.0317***
Emotional stability											–0.0141	0.0307
Openness to experience											0.0630	0.0308*
Constant	0.1599	0.0725*	1.4416	0.1353***	0.6663	0.2023***	2.3857	0.2965***	1.6155	0.3164***	0.9776	0.5504
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. Standard errors account for clustering within households.

***p < 0.001; **p < 0.01; *p < 0.05.

both of which are significant determinants of hardship, and which favor younger people. Nevertheless, their inclusion only modestly increases the age effect.

In Model 2b we add wealth and housing tenure, both of which heavily favor 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 controls (Model 2c), which increase the age effect, because older people have poorer health on average. But this change in the age coefficient is small. Whilst few of the health controls are individually significant, health is highly significant in a joint test. The results are virtually identical when a two-factor summary (physical health and mental health) of the SF-36 is used instead.

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." The numbers of people in the household in each age group are significant determinants of hardship, as resources are shared. Since younger couples have more dependants on average, this results in a further fall in the age effect by 0.003.[19]

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.[20] 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 percent of the raw age relationship.[21] However, age remains highly significant.

[19]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. Similarly, we do not control for who (within the household) pays the bills, but the inclusion of such (individually-reported) indicators has no substantive effect on the results.

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

[21]If singles living alone are also included in the samples for Models 1 and 4, observed resources and needs account for 65 percent of the raw age relationship. This percentage is unchanged (65 percent) 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).

There is little evidence that the effects of the respondent's own characteristics differ from the effects of partner's characteristics.[22] Indeed for most significant variables (labor force status, education, personality) such point estimates 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. In 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.

We note that the role of resources in explaining the age gradient may be underestimated. This is because we do not have a good measure of credit availability, which is likely to favor older people, even after accounting for wealth. However, we can shed some light on this. Respondents report on ability to raise $2000 in an emergency, a proxy for credit availability. When this variable is included in Model 4 as an additional measure of resources (along with the partner's response) the age coefficient falls in magnitude by a further 10 percent of the raw gradient. However, the estimated coefficient on the person's own response is considerably larger than the coefficient on the spouse's response to this question. This strongly suggests that this self-reported ability to raise $2000 variable is also picking up a tendency to under-report hardship. Thus it may not be a valid proxy. We also sought a proxy for income stability, which may also favor older people. We considered the coefficient of variation in equivalized annual household income across the seven waves, restricted to a balanced panel of couples. The inclusion of this variable actually increases the age coefficient, since the coefficient of variation is relatively low among young people. However, the variable may not adequately measure the existence of unanticipated (and possibly short-term) fluctuations in income. Note also that using income after housing costs does not change the age gradient, though it does increase the contribution of income in explaining the age gradient.

5.2. *Within Couple-Year Results*

The majority of the age relationship is explained by observed resources and needs. Nevertheless, 39 percent of the relationship has not been explained by observed characteristics. 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-year fixed effects models.

The results from the couple-year fixed effects Poisson regressions 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

[22]There is some evidence that own health has a larger effect than spouse's health. This suggests that poor self-reported health is correlated with a tendency to report more hardship (independently of the direct effect of health as a resource). This means that the already small change in the age coefficient resulting from the inclusion of health controls (compare Models 2b to 2c) is overestimated. This is not a major complication for the analysis, since health is clearly a minor factor in the age–hardship relationship.

TABLE 3
FIXED EFFECTS "WITHIN COUPLE-YEAR" POISSON REGRESSION RESULTS

	Model 5a		Model 5b	
Variable	Coefficient	SE	Coefficient	SE
Age	–0.0035	0.0035	–0.0006	0.0046
Labor force status				
Unemployed			0.0167	0.0822
Not in labor force			–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 ($'000)			–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 health			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	48,089		37,791	

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. Standard errors account for clustering within households.
***p < 0.001; **p < 0.01; *p < 0.05.

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 is that age is not statistically significant in the within couple-year models. 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 percent (or 2 percent in Model 5b). Further, the estimates are precise enough to rule out any particularly large effects of age. For example, the 95% confidence interval for the age coefficient in Model 5a is (–0.010, 0.003). The corresponding range for the effect of a 40-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.

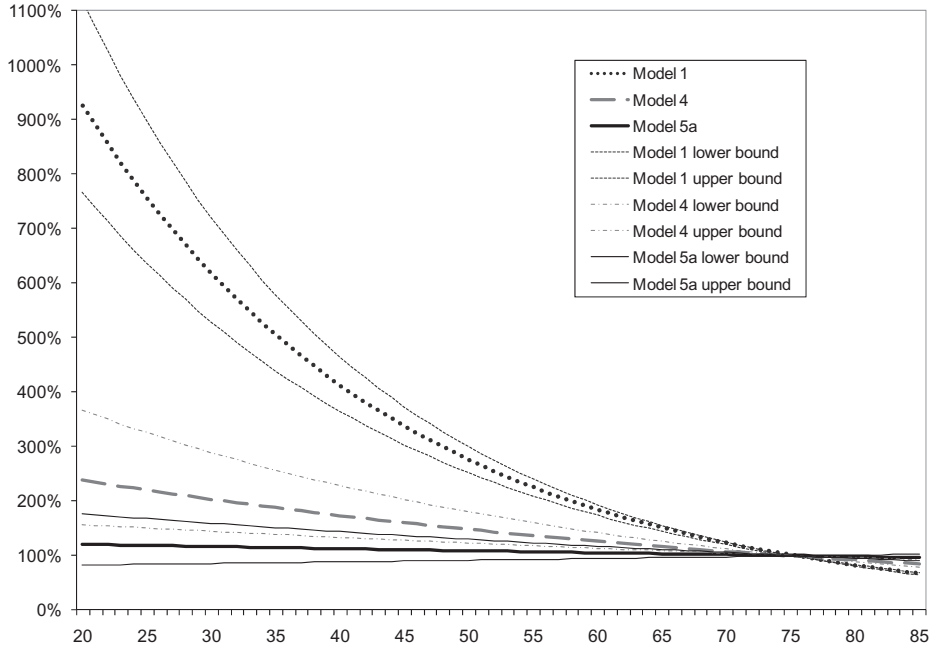

Figure 3. Estimated Effect of Age on Reported Household-Level Hardship (index = 100% for age = 75 years), Selected Models

Notes: This figure summarizes 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 summarizes 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 coefficient 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 Poisson model, with 95% CIs.

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 the effect of age after controlling for couple-year 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 coefficient 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

[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.

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. *Robustness Tests*

We show here that the results are similar when each indicator is analyzed individually. We also consider a further binary model where the dependent variable takes the value of 1 when at least one of the household-level indicators is reported by the respondent.

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).

The results in Table 4 largely mirror those of the earlier analysis. In Model 1, age is a strong and statistically significant predictor for each indicator. Much of the age effect is explained by observed characteristics (in Model 4, the differences between the age odds ratios and unity are 50, 43, and over 100 percent smaller than in Model 1, for the three indicators, respectively), and age is not significant in the fixed effects models. Thus the main results are not sensitive to the analysis of the household-level indicators individually. For "unable to heat home" (the indicator

TABLE 4

Robustness Tests: Estimated Age Odds Ratios from Logit Regressions

	Model 1		Model 4		Model 5a		Model 5b	
Dependent Variable	Odds ratio	SE	Odds ratio	SE	Odds ratio	SE	Odds ratio	SE
Could not pay electricity gas or telephone on time	0.9551	0.0020***	0.9778	0.0053***	0.9845	0.0091	0.9828	0.0125
Could not pay mortgage/rent on time	0.9568	0.0024***	0.9756	0.0069***	1.0048	0.0111	1.0273	0.0164
Was unable to heat the home	0.9797	0.0045***	1.0087	0.0117	0.9974	0.0178	1.0068	0.0302
	0.9529	0.0019***	0.9767	0.0052***	1.0071	0.0075	0.9962	0.0117
At least one household-level hardship	0.9551	0.0020***	0.9778	0.0053***	0.9845	0.0091	0.9828	0.0125

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 indicator. Standard errors account for clustering within households.

Odds ratio is significantly different from 1 at ***p < 0.001; **p < 0.01; *p < 0.05.

with the least variation), the age effect is completely explained by observed characteristics.[24]

6. Further Issues

Now we address several issues which may be seen to threaten the validity of our approach.

6.1. *Collusion*

A potential limitation of the within couple-year 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 percent 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 percent. 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.

6.2. *Do Age Effects Within Couple-Years 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 are not concerned about the

[24]We also repeated the analysis after limiting the sample to Waves 2 and 6 only (to correspond with Models 2b, 2c, and 4), which did not substantially alter the results. The age coefficients for the affected models are as follows: Model 1: –0.0387 (0.0024)***; Model 2a: –0.0442 (0.0024)***; Model 5a: 0.0005 (0.0052); Model 5b: 0.0069 (0.0073).

TABLE 5

Fixed Effects "Within Couple-Year" Poisson Regression Results for Subpopulations

	Model 5a	
Subpopulations	Coefficient	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
Couple's average age less than 45 years	–0.0038	0.0040
Couple's average age 45 years or more	–0.0030	0.0065

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. Standard errors account for clustering within households.

Odds ratio is significantly different from 1 at ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

role of personality, since our analysis shows no impact of personality on reporting issues.[25] In any case, we control for the "Big 5" 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 dataset that would facilitate such an investigation. Papers in the assortative mating literature typically use samples of around 100–300 couple observations (see, for instance, Tambs *et al*., 1993; Gruber-Baldini and Willis, 1995; Dufouil and Alpérovitch, 2000).[26] 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 non-linear, 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 non-linear 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

[25]We find that personality operates as a resource rather than as a source of reporting differences (see Section 5).

[26]Some studies use larger samples, but none appear to have cognitive measures.

data, most respondents began living with their current partner during early adulthood (prior to the age of 35 years in 87 percent of observations and before the age of 45 in 95 percent 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.

7. 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 behavioral 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 percent) 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 favor older people.

However, a substantial component (31 percent) of the gradient is explained by unobserved differences between households. We have argued that this is likely to reflect behavioral choices that vary with age. This finding needs to be interpreted with some care. Such behavioral choices may, in turn, reflect older people's greater experience with managing finances, an (unobserved) resource. On the other hand, past behavioral choices determine current resources. Thus the delineation between the components of the age gradient explained by resources and behavioral 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. We also find little evidence that reporting error is correlated with other observable characteristics. However, it does not necessarily follow that the extent of reporting error is small. In a related context, recent work by Gundersen and Ribar (2011) suggests that self-reports understate actual food insecurity. See also Breunig and McKibbin (2011-forthcoming) for a discussion of the possibly major role of survey design on reporting of financial hardship.

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 behavioral choices are an important contributor to hardship. To the extent that these behaviors 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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