Family resources and cognitive decline among elderly in Italy

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Abstract

Family ties may play an important role in the wellbeing of the elderly. In this paper, we examine the association between living arrangements and the cognitive decline among people over 65 in Italy in the hypothesis that living with others (i.e. children and/or spouse) vis –à- vis living alone may have positive effects on cognitive functioning. To this end we used data from the first two waves of the Survey of Health, Ageing and Retirement in Europe (SHARE), which provides five indicators of cognitive functions: orientation, memory, recall, verbal fluency and numeracy. Cognitive decline was measured considering the differences between the first and the second wave in each of these five indicators.

Preliminary results reject the hypothesis of a protective effect of living with others. In particular, living with others during the old age seem to worse their cognitive abilities (at least in one dimension) more than living alone, net of other confounding covariates. Further analyses taking into account potential bias connected with selection provided by attrition between the first and the second wave confirm and strengthen these results, but only for elderly whose abilities was very poor at the first interview. The potential bias due to the "re-test effect" suggest that this effect could be even stronger for old people living with the spouse (a significant re-test effect was indeed found for couples regards verbal fluency and orientation).

1. Introduction

Family and children may play an important role in the wellbeing of the elderly (Zunzunegui et al., 2001). The effect of living arrangements on cognitive functioning is hardly debated in the literature. Nevertheless, this might be of particular interest in ageing societies: future elderly will have narrower kinship networks due to decreasing fertility, increasing female participation to labour

market, and increasing divorce rates. In addition, given the increasing trend of life expectancy, they will experience higher risks of degenerative diseases. Therefore, if living arrangement in later life significantly affects health of elderly, this will inevitably have repercussions in the wellbeing of future elderly. According to the existing literature, the living arrangements of older persons may be important, even though results show mixed evidence (Hays, 2002). Living alone has been associated with better mental health and vitality over time (Michael et al., 2001), but other works stressed the benefits of moving closer to or into the same residence with others (De Jong Gierveld and Van Tilburg, 1999). Clearly, elderly living with children are more likely to be selected, i.e. those with worse health are less likely to be left alone, and therefore more likely to live with their children, if they have any. In general, co-residence with children may mean support for the psychological health of elderly parents, even in case of decrease of autonomy and physical and economic dependence. At the opposite, older adults living alone may be more vulnerable to decreased psychological wellbeing and to adverse health outcomes (Kharicha et al., 2007, Van Gelder et al., 2006).

In this light, we examine the association between living arrangements and the cognitive decline among people over 65 in a context, such as Italian one, characterized by strong family ties and – at the same time, a particularly old age structure. We might expect that, in general, living with others may have positive effects on cognitive functioning. On the one hand, living with a spouse provides more psychological support than living alone; on the other hand, co-residence with offspring may provide more social and practical support and a sense of security. These different forms of support obtained when living with others should lead beneficial effects and consequently a lower decrease of elderly cognitive functioning in comparison with that of elderly living alone.

Data come from the first two waves of the Italian sample of the Survey of Health, Ageing, and Retirement in Europe (SHARE), which provides information on five cognitive abilities (orientation, memory, recall, verbal fluency, and numeracy). In particular, cognitive decline is measured considering the differences in the several abilities, between the first and the second wave for individuals aged 65 or over. In order to assess whether there is a causal effect of living arrangement on cognitive decline, separate multivariate analyses are carried out for each cognitive domain. In the analyses particular attention is paid to the potential selection due to attrition. Moreover, we test for the presence of another potential source of bias arising from what is generally referred to as “re-test effect”, that is the improved performance over time because of repeated test exposure. Analyses of this effect conducted with an innovative approach in comparison with literature (Ferrer et al., 2004) suggest, indeed, that at least in some cases, re-test effects are not negligible.

2. Background

Several reasons have been suggested to explain why living arrangements are important for health. Presumably, co-residential arrangements should be better than living alone in protecting health for elderly because of the availability of social support, regulation of health behaviour, supply and consumption of economic resources (in economy of scales), and demands on individual roles (Lund et al., 2002).

In fact, literature has shown mixed evidence (Hays, 2002). Some studies have reported that older persons living alone were at greater risks for poor physical health (Kharicha et al., 2007) and cognitive decline (Van Gelder et al., 2006) than those living with others. However, others found that there are no differences in health according to the living arrangements (Hughes and Waite, 2002), and still others reported that living alone may have some health advantages (Michael et al., 2001). In sum, the literature is not clear on whether elderly living alone have advantages or disadvantages. The inconsistency may be due to different operationalization used for living arrangements, to gender differences, and to age and culture considered in the analyses. In addition, data from cross-sectional studies indicating that living alone is not related to poor health outcomes should be considered with caution since it is not possible to exclude selection or reverse causation as an explanation for these results (perhaps, elderly living alone are a healthier group).

In general, health conditions being equal, living with others is expected to have advantages in comparison with living alone. Older adults who live alone are, indeed, more vulnerable to social isolation and living alone is often considered as a "social frailty" indicator (see, for example, van Campen, 2011 and Casale-Martínez, 2012). At the opposite, a high level of social and intellectual stimulation can characterize elderly living with others. From the viewpoint of cognitive functioning, this stimulation may increase neuronal growth and maintenance, and thus protect the brain from deterioration and subsequent cognitive decline (Coyle, 2003)[1]. Furthermore, in the same perspective, living alone after the loss of a partner could mean changes in lifestyle or even stress and depression. From one hand, changes in lifestyle such as a decrease in physical activity or an increase in smoking and alcohol drinking may have a negative effect on cognitive functioning (Van Gelder et al., 2004); from the other hand, stress and depressive symptoms lead to an increase in cortisol production, which may damage hippocampal, the part of the brain where memory is located (and this may result in memory problems, see Kalmijn et al., 1998). The beneficial effect for elderly health of living with children and the opposite effect of living alone seem to be more evident in

[1] However, it could be that older people in good health living alone may be more prone than the others to have active behaviours and this might prevent them from cognitive decline.

those cultural contexts where intergenerational ties are traditionally strong and co-residence with children is common (Zunzunegui et al., 2001; Wang et al., 2001; Cui, 2002).

In fact, research on living arrangements typically focuses on its connection to functional and psychological status and mortality (see also Chen and Silverstein, 2000; Sun, 2004), and studies focused on cognitive aspects usually consider the risk of dementia or Alzheimer's disease (Helmer et al., 1999, Sibley et al., 2002). Very few authors analysed the effect of living arrangement on cognitive decline (Van Gelder et al., 2006; Håkansson et al., 2009). Their results confirm the protective effect against cognitive impairment later in life of living with others, even if they use a global cognitive functioning indicator which does not assess specific cognitive domains in detail (see the discussion on the limitation of Mini-Mental State Examination in Van Gelder et al., 2006).

3. Data, methods, and preliminary analyses

Data used in this paper come from the first two waves (in 2004 and 2006/2007) of the Italian sample of SHARE. This dataset provides longitudinal information on health and socio-economic status, and social and family networks of non-instituzionalized[2] adults aged 50 or over representing the various European regions (Börsch-Supan et al., 2005). The sample we use is based on individuals aged 65 or over in the first wave, who are interviewed also in the second wave: in this way, the present paper focuses on 770 individuals (68.6% of the persons aged 65 or over in the first wave) still alive in the second wave (49 individuals corresponding to 4.4% died before the second wave and 304 individuals have not been re-interviewed but we do not why).

Five different measures for cognitive functions are available: orientation, memory, recall, verbal fluency and numeracy. Orientation is a basic cognitive functioning indicator measuring orientation for time (date, month, year and day of the week). Memory and recall refer to the ability of recalling some words from a list of ten items, immediately after the list and after a certain delay, respectively. Verbal fluency is an indicator of executive function and more precisely it is defined by the number of different animals that the interviewee can name within one minute. Numeracy measures the ability to perform numerical operations. Each ability was measured with different tests leading to different measures: orientation and numeracy are described by five-categories variables; memory and recall range from 0 to 10, and verbal fluency has values ranging from 0 to 33[3] in the current sample. For all abilities higher score implies higher ability. These measures of cognitive functioning assess the so-called fluid intelligence (Engelhardt et al., 2010), that reflecting performance in

[2] The focus only on non-instituzionalized population clearly leads to an overestimation of wellbeing.

[3] In fact, we do not consider in the analyses an individual having a score of 100, since it is probably a not plausible value.

learning and processing new material and comprising perceptual speed and reasoning abilities tends to decline substantially over the adult lifespan (Verhaegen and Salthouse, 1997).

Cognitive decline was measured considering the differences between the scores in the first and in the second wave[4], separately for each of the five indicators of ability measured for individuals aged 65 or over. Thus, separate multivariate analyses, in which the differences for each abilities are the response variables, are used. The key independent variable is the living arrangement, which was categorized as follows: living alone, with the spouse (only), with children (with or without a spouse)[5]. Other covariates[6] included in the models control for factors which literature has revealed to be important for cognitive decline (see the review by Engelhardt et al., 2010) and which can be source of bias, being connected with living arrangement.

First of all, health is one of the most significant determinants of living arrangements: individuals living alone are probably those with a good health and a high cognitive level. So the first aspect that should be controlled for is the baseline cognitive functioning (measured at wave 1, for each of the five abilities): memory, recall, and verbal fluency at wave 1 are considered as continuous covariate, whereas orientation and numeracy are dichotomized[7]. Health status is measured also considering the diagnosis of some chronic diseases (heart disease, stroke, and diabetes), the level of difficulty in performing eight Instrumental Activities of Daily Living (IADL), and the mental health (measured by the EURO-D scale – Prince et al., 1999). Physical function was categorized as normal (without any difficulty), mild disability (with difficulty in one or two activities of IADL) and severe disability (with difficulty in more than two activities of IADL). Respondents with EURO-D scores ranging from 0 to 3 were defined as "no depressed", those with 4 or 5 as "mildly depressed", while those with more than 5 as "severely depressed".

Similarly, other socio-economic and socio-demographic background factors should be taken into account.

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[4] In order to exclude greater declines in cognitive functioning as a result of very poor health, the analysis was restricted to healthier respondents, excluding those who were severely cognitively impaired at baseline (individuals with cognitive abilities in wave 1 equal or under the 5th percentile). This threshold corresponds to a score of 2 for orientation (in this way, 37 observations are neglected), 1 for memory (70 observations are excluded), 0 for recall (159 individuals are not considered), and 5 for verbal fluency (3 observations are neglected). Clearly, missing data for one of the variables retained in the analysis was another criterion for exclusion.

[5] Other more complex family forms (for example, living with other relatives) were ignored because of few cases.

[6] Tables A in the Appendix report the percentage distribution of each covariate for the individuals interviewed both in the first and in the second wave of SHARE also according to the living arrangement in the first wave.

[7] Respondents having a score in orientation less than 4 are distinguished from those with score equal 4; respondents with score in numeracy 2 or less are distinguished from those with a score of 3 or more.

Socio-demographic factors include age, gender, and educational level. A measure of social involvement is also considered (being connected with better cognitive performance, see, for example, Engelhardt et al., 2010). Education was divided into three categories: low (illiterate or elementary), middle (secondary school), and high (high school or above). Social involvement is measured considering whether the respondent has undertaken at least one social activity[8] within the previous month before the interview.

In addition, the household economic situation is considered through the household total net worth[2]. The differences in the number of household members are accounted dividing wealth by the square root of household size (Avendano et al., 2009). In the following analyses, wealth is collapsed into quartiles.

Furthermore, we add geographical controls: both the area of residence (North, Centre, and South) and the type of area (a big city, the suburbs or outskirts of a big city, a large town, a small town, a rural area or village) are considered.

Lastly, the presence of individuals during the cognitive section of the interview both in the first and in the second wave of the survey is taken into account.

In multivariate analyses, a potential selection effect which should be kept in mind is due to attrition. Respondents experiencing a heavier cognitive decline are more at risk of death, institutionalization, or health decline, and so less likely to be interviewed in the second wave, leading to a missing outcome for those who are interviewed only once. Therefore we might expect that the effect of living arrangement on cognitive decline (if any) would be biased if this kind of selection is not properly taken into account.

This selection effect was taken into account by weighting individuals in the regression models. In particular, calibrated longitudinal weights were used (for details on the weights and on the calibration procedure see SHARE Release Guide 2.5.0 waves 1& 2, Mannheim Research Institute for the Economics of Aging, 2011).

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[8] Seven types of social activities are considered in the questionnaire: voluntary or charity work, care provided for sick or disable adults, help provided to family, friends or neighbours, educational training, participation in a sport, social or other kind of club, participation in a religious organization, and participation in a political or community organization

[2] Following the definition used by other researches (see Avendano et al., 2009), this is "the sum of all financial (net stock value, mutual funds, bonds, and savings) and housing wealth (value of primary residence net of mortgage, other real estate value, own business share, and owned cars) minus liabilities". Missing items were imputed using the methodology of multiple imputation (see SHARE Release Guide 2.5.0 waves 1& 2, Mannheim Research Institute for the Economics of Aging, 2011).

Table 1 reports the mean differences in the score between the first and the second wave in different abilities according to the living arrangement in 2004[9]. Higher positive differences imply greater cognitive decline; we note some negative values (meaning that the score in the second wave is higher than that in the first one), and, particularly striking is the figure for verbal fluency which suggests that people living alone improve their performance over time. This odd result may be due to the so-called re-test effect, an issue that will be tackled in section 6. In these descriptive statistics, the "effects" of living arrangement seem to be different according to the specific measure of cognitive decline: individuals living alone show the highest decline in orientation, but the opposite happens for some other abilities, such as memory and verbal fluency, for which individuals living with children show the highest decline. Intermediate figures characterize elderly living only with their partners. In fact, only decline in verbal fluency are significant different across living arrangement. Contrary to our expectations, it seems that living alone is a protective factor for cognitive decline (individuals living alone show even an improvement in their verbal fluency) and co-residence with offspring is connected with higher cognitive decline. The association between living arrangement and verbal fluency decline is very low for individuals living only with their partners.

Table 1. *Mean differences in the score between the first and the second wave in different abilities by living arrangement (standard deviations in parentheses).*

	Living alone	**Couple alone**	**Living with children**	**Test F* (p-value)**	**N**
Orientation	0.210 (0.862)	0.183 (0.815)	0.071 (0.812)	1.567 (0.2094)	669
Memory	0.058 (1.525)	-0.046 (1.556)	0.246 (1.605)	1.964 (0141)	626
Recall	0.295 (1.827)	0.103 (1.783)	0.307 (1.545)	0.909 (0.404)	535
Verbal fluency	**-0.822** (5.465)	**0.040** (4.318)	**0.733** (3.992)	3.638 (0.027)	626
Numeracy	0.177 (1.056)	0.161 (0.941)	0.218 (0.959)	0.188 (0.828)	581

* Test F verifies the null hypothesis of equality of the three mean differences.

Clearly, these descriptive results do not control for other factors which literature has revealed to be important for cognitive decline described in the previous section.

[9] Besides individuals with cognitive abilities in wave 1 equal or under the 5th percentile also 35 other individuals living in other family forms are excluded due to their small sample size.

4. Results

As described above, cognitive decline was measured considering the differences between the scores in the first and in the second wave separately by ability. Results reported in Table 2 refer to the coefficients describing differences, thus, positive values indicate a coefficient associated with a greater deterioration of cognitive ability between the first and the second wave, and a negative value implies a lower cognitive decline. Models 1 are those without weights and models 2 use calibrated weight to take into account potential selection due to attrition.

Results of models 1 show that, net of other controls, the effect of living arrangement is significant only for verbal fluency. In particular, it seems that, contrary to our hypotheses, living with children or with a partner implies a greater decline in verbal fluency in comparison with living alone. However, the net effect of living arrangement on cognitive decline is given by the sum of the main coefficient and the interaction term, which appears to be significant only for elderly living with children and which goes in the direction of decreasing the verbal fluency decline. Thus, a protective effect of living with children is observed for individuals with high cognitive function (in verbal fluency) at start.

Weighted models show that the bias of attrition should be taken into account, particularly for verbal fluency: the coefficients related to both the main effect of living arrangement and interactions increase. Graphics in figure 1 can help the interpretation. The last one shows that the negative effect of living with other is strong for individuals with low verbal fluency in the first wave; at the opposite, for elderly with high ability in verbal fluency, living with others is a protective factor against its decline. The differences across living arrangements are not so strong in the other cognitive abilities (the first two graphics refer to memory and recall, respectively).

Table 2. *Estimates of coefficients related to living arrangements in models describing differences in cognitive abilities between the first and the second wave (standard errors in parentheses).*

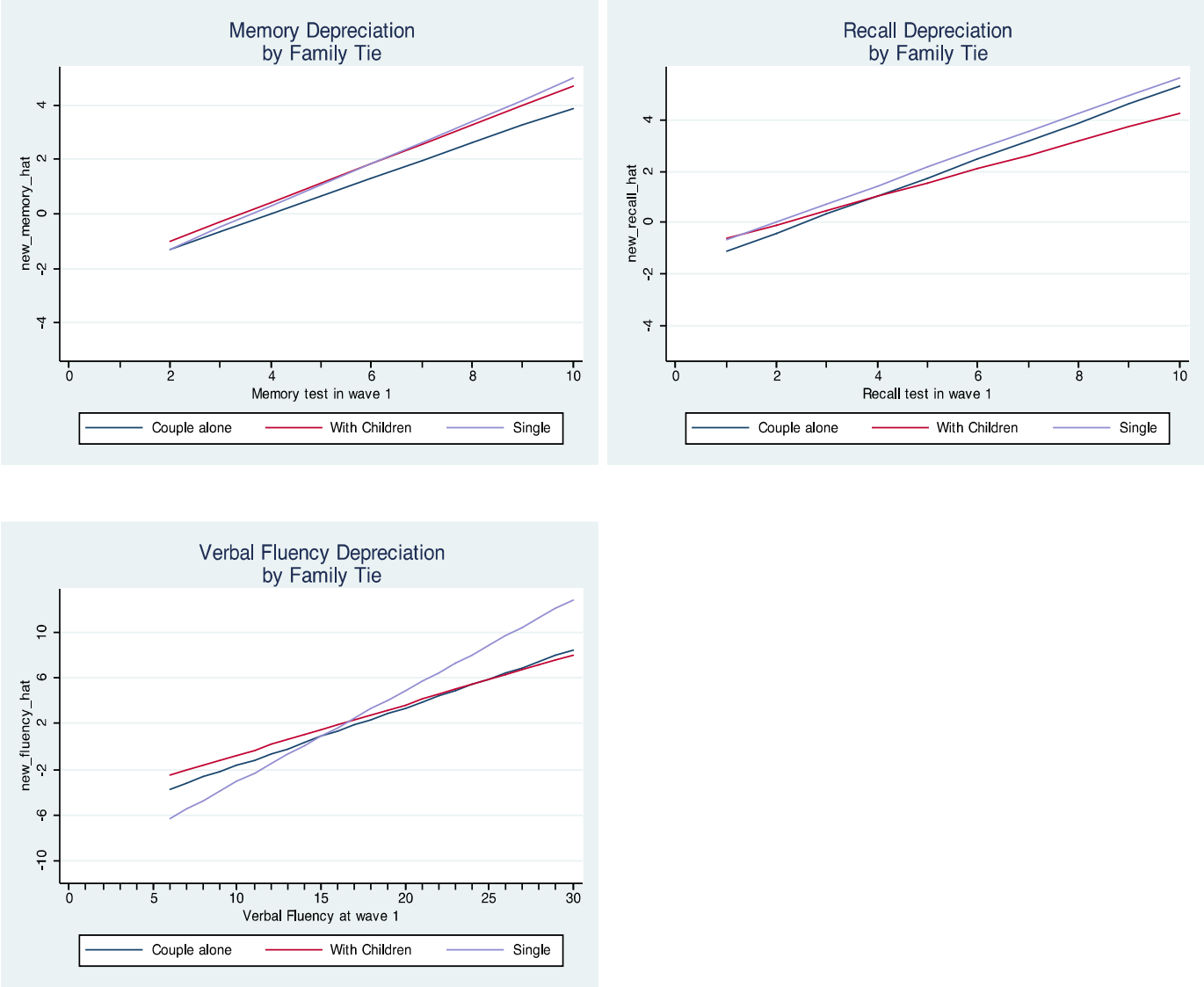
	Model 1		Model 2 (weighted)	
Orientation				
Living arrangements (ref: *living alone*)				
Couple alone	0.0921	(0.1532)	0.0700	(0.1616)
Living with children	0.1670	(0.1876)	0.3309	(0.2200)
Orientation in wave 1 (ref: *low orientation*)				
High orientation	1.0433***	(0.1206)	1.0553***	(0.1303)
Interactions				
High orientation*couple alone	-0.1680	(0.1689)	-0.1387	(0.1837)
High orientation*with children	-0.2879	(0.1968)	-0.4181*	(0.2322)
N	656		656	
Adjusted R-squared	0.259		0.285	

Memory				
Living arrangements (ref: *living alone*)				
Couple alone	0.2165	(0.4709)	0.2514	(0.5035)
Living with children	0.2613	(0.4969)	0.3856	(0.5426)
Memory in wave 1	0.7939***	(0.1039)	0.7791***	(0.1025)
Interactions				
Memory*couple alone	-0.1209	(0.1162)	-0.1326	(0.1215)
Memory*with children	-0.0541	(0.1221)	-0.0626	(0.1293)
N	616		616	
Adjusted R-squared	0.281		0.281	
Recall				
Living arrangements (ref: *living alone*)				
Couple alone	-0.6045	(0.3829)	-0.4554	(0.4397)
Living with children	-0.0644	(0.3982)	0.2034	(0.4642)
Recall in wave 1	0.6330***	(0.1285)	0.7055***	(0.1428)
Interactions				
Recall*couple alone	0.0565	(0.1492)	0.0127	(0.1778)
Recall*with children	-0.0654	(0.1505)	-0.1599	(0.1789)
N	527		527	
Adjusted R-squared	0.270		0.306	
Verbal fluency				
Living arrangements (ref: *living alone*)	**			
Couple alone	2.8311**	(1.2655)	3.3908**	(1.3278)
Living with children	3.2331**	(1.3811)	3.6909**	(1.5453)
Verbal fluency in wave 1	0.6486***	(0.0819)	0.7004***	(0.0835)
Interactions				
Verbal fluency*couple alone	-0.1730*	(0.0914)	-0.2214**	(0.0919)
Verbal fluency*with children	-0.1609	(0.1010)	-0.2043*	(0.1090)
N	673		673	
Adjusted R-squared	0.261		0.288	
Numeracy				
Living arrangements (ref: *living alone*)				
Couple alone	-0.1656	(0.1615)	-0.1602	(0.1730)
Living with children	-0.0054	(0.1686)	-0.0240	(0.1929)
Numeracy in wave 1 (ref: *low numeracy*)				
High numeracy	0.6976***	(0.1992)	0.8362***	(0.2067)
Interactions				
High numeracy*couple alone	0.1469	(0.2199)	0.0876	(0.2341)
High numeracy*with children	0.0506	(0.2407)	0.0068	(0.2660)
N	569		569	
Adjusted R-squared	0.164		0.213	

Significance levels: ***, 0.01; **, 0.05; *, 0.1

All models control also for the covariates described in section 3: health (through the diagnosis of heart disease, stroke, and diabetes, the physical functioning, and the mental health), socio-demographic and economic factors (age, gender, education, social involvement, wealth, and residence), and the presence of other individuals during the interview.

Figure 1. *Estimates of cognitive decline (in memory, recall, and verbal fluency) by living arrangements in wave 1 (adjusting all covariates to median values).*



5. Re-test effect

An important source of bias in longitudinal studies on cognitive abilities is the phenomenon of "re-test effect": at each assessment of cognitive ability, people might learn from the test performed in the previous interview, and this might influence the performance and the next measurement. This effect may be particularly important in the present paper if it varies across living arrangements.

Re-test has been tested in several ways (Ferrer et al., 2004) and it has been found that it produces an upward bias in cognitive abilities measurement. Up to now all the papers which tackle this issue uses panel data with more than two waves (Ferrer et al. 2004). Unfortunately, given our

data limitation (we have only two waves), none of the models suggested by literature to separate retest effects (Ferrer et al., 2004) can be applied to our data. Thus, an alternative approach is proposed in the present paper. Re-test effects are estimated using data from wave 2 and comparing cognitive abilities of individuals who have been interviewed also in the first wave with those of individuals who are interviewed for the first time (refresh sample).

In fact, the two groups of individuals may be qualitatively different in terms of many background variables, and we need to control for these variables if we aim to tease out the effect of being interviewed both in the first and in the second wave from the spurious dependence brought about by these variables. We use propensity score matching to isolate this effect (Rosenbaum and Rubin, 1983). More in detail, we define as "treated" all the individuals who are observed for the second time in wave 2 (2006/2007)[10] and as "control" the refresh sample. Then separately by living arrangement (i.e. living alone, couple alone, living with children), we perform a 1-to-n matching to align the distribution of the "treated" with the "control" one. To this end we stratify the sample by two dimensions (education gender), thus generating 4 cells. We aligned the cells according to the geographical region (North, Centre, and South) and to the health status (no problems in Activity Daily Living activities vis-à-vis at least one problem) and cohort (born before or after 1930).

Table 3 shows the results of the logit model used to estimate the propensity scores. The propensity to be interviewed twice is lower among younger and more educated individuals, while we found that people living in the South (vis-à-vis living in the centre of the country) are more likely to be interviewed twice, although the differences appear to be statistically different only for couples living by themselves.

The following estimates of re-test effects were computed net of these variables controlling for basic background characteristics and conditioning to household structure. For sake of clarity, after having got rid the observables differences between the "treated" and the "controls", we regress the cognitive ability on year of birth, years of education, gender, geographical region and to the health status (defined as above), year dummies (more precisely the interview year 2006 vs. 2007) and the probability of being interviewed for the second time in the second wave vis-à-vis belonging to the refresh sample (the afore defined "treated"). Table 4 shows that there is a significant retest effect in two cognitive abilities (orientation and verbal fluency) only for individuals living in families composed by couples alone, as well for elderly living by themselves. Although, it is worth noting that our estimates reveal that the retest effect for old people living alone is slightly significant at 10% only.

[10] A respondent with verbal fluency of 100 in wave 2 is excluded from the analyses, since it is probably a not plausible value (see footnote 3).

Table 3. *Logit model on the probability of being interviewed in both waves (estimates for propensity score – standard errors in parentheses).*

	Living alone		Couple alone		Living with children	
Intercept	0.5815	(0.6251)	0.1644	(0.3021)	0.7633	(0.4926)
Age (ref: *born in 1930 or after*)						
Born before 1930	0.2812	(0.3059)	0.4642**	(0.1909)	0.0632	(0.2995)
Gender (ref: *males*)						
Females	0.3529	(0.3542)	0.3108*	(0.1624)	-0.1454	(0.2598)
Education						
(ref: *less than 5 years of education*)						
5 or more years of education	-0.4640	(0.3710)	-0.4074**	(0.2073)	-0.0824	(0.2941)
Health						
(ref: *one or more limitation on ADL*)						
No ADL problems	-0.3830	(0.3975)	0.1293	(0.2241)	-0.0804	(0.3357)
Residence (ref: *Centre*)						
North	0.3149	(0.4156)	0.0441	(0.1952)	-0.5998*	(0.3394)
South	0.3881	(0.4247)	0.4389**	(0.2078)	-0.4548	(0.3080)
Number of observations	218		692		277	

Robust standard Errors

Significance levels: ***, 0.01; **, 0.05; *, 0.1

Table 4. *Estimates of retest effects (and standard errors) in different cognitive abilities according to the living arrangements.*

	Living alone	Couple alone	Living with children
Orientation	0.2161*	0.1118***	-0.0580
	(0.1172)	(0.0281)	(0.1375)
Memory	0.1851	-0.0322	0.0416
	(0.2224)	(0.04303)	(0.1993)
Recall	-0.2406	-0.0469	0.2123
	(0.2454)	(0.0426)	(0.2136)
Verbal fluency	1.166*	0.6052***	-0.9649
	(0.6934)	(0.1142)	(0.6682)
Numeracy	-0.1824	0.0065	-0.0062
	(0.1412)	(0.0249)	(0.1123)

Bootstrapped Standard Errors (1,000 replications)

Significance levels: ***, 0.01; **, 0.05; *, 0.1

At the light of the significant re-test effect among couples in two cognitive abilities: namely verbal fluency and orientation, we should interpret with caution the results of multivariate analysis described above (section 4).

6. Discussion and conclusion

The present work is the first attempt to study the impact of living arrangement on cognitive decline in Italy, a country characterized by a very old age structure and by strong family ties. The fact that in this context intergenerational ties are traditionally strong and co-residence with children is common might imply that the beneficial effect of living with children is more evident and, at the opposite, the negative effect of living alone might be stronger than those observed in other countries. In addition, in comparison with other European studies on the topic, cognitive functioning is measured in detail assessing specific cognitive domains, more precisely, orientation, memory, recall, verbal fluency, and numeracy. A further strength of the paper is that it considers the potential selection due to attrition. Lastly, the paper tries also to give a measure of the so-called re-test effect.

Results show that the hypothesis of a protective effect of living with others is not confirmed, but, in fact, it holds for individuals with high cognitive function (in verbal fluency) at start. The negative effect of living with children for those with low verbal fluency may be explained by the decline in self-esteem associated with the loss of autonomy and physical and/or economic dependence.

Clearly, further studies are needed to study more in detail these aspects.

First, preliminary analyses on the so-called re-test effect show that it is not negligible and, thus, also this bias should be controlled for. Second, in old age, transitions in living arrangement as well as cognitive decline are very common. An analysis which takes into account also the changes in the living arrangements between the first and the second wave should be considered, but the sample size does not allow to apply this approach. In addition, the definition of the living arrangement should be studied more in depth: for example, the conditions characterizing those living alone should be examined. Further examinations regard the potential criteria of exclusion: as observed by some authors (see Engelhardt et al., 2010), it should be important to exclude greater declines in cognitive functioning as a result of poor health, restricting the analyses to healthy respondents.

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APPENDIX

Table A. *Percentage distribution of covariates according to the living arrangements in the first wave for the sample of individuals interviewed both in the first and in the second wave.*

	Living alone	Couple alone	Living with children	Total
Orientation in the first wave				
% with score under 4	0.179	0.163	0.221	0.182
% with score equal 4	0.821	0.837	0.779	0.818
Standard deviation				
Memory in the first wave				
Mean value	3.293	3.583	3.526	3.515
Standard deviation	1.503	1.478	1.645	1.532
Recall in the first wave				
Mean value	1.870	2.024	2.200	2.045
Standard deviation	1.504	1.635	1.815	1.666
Verbal fluency in the first wave				
Mean value	11.350	12.799	12.152	12.360
Standard deviation	4.947	4.978	2.297	5.085
Numeracy in the first wave				
% with score under 3	0.503	0.412	0.463	0.459
% with score 3 or more	0.407	0.588	0.537	0.541
Standard deviation	0.493	0.493	0.500	0.499
% with diagnosis of heart disease	0.122	0.150	0.142	0.143
% with diagnosis of stroke	0.016	0.042	0.052	0.041
% with diagnosis of diabetes	0.163	0.147	0.168	0.156
Physical function				
Normal (without any difficulty in IADL)	0.748	0.834	0.789	0.806
Mild disability (with difficulty in one or two difficulty in activities of IADL)	0.163	0.120	0.121	0.128
Severe disability (with difficulty in more than two activities of IADL)	0.089	0.046	0.090	0.066
Mental health				
No depressed (EURO-D scores from 0 to 3)	0.341	0.535	0.521	0.496
Mildly depressed (EURO-D scores from 4 to 5)	0.407	0.307	0.274	0.316
Severely depressed (EURO-D scores 5 or more)	0.252	0.158	0.205	0.188
Mean age	74.76	72.31	71.91	72.64
% male	0.211	0.540	0.500	0.470
Educational level				
Low	0.659	0.711	0.658	0.687
Middle	0.106	0.118	0.174	0.131
High	0.130	0.110	0.095	0.109
% with social involvement	0.244	0.176	0.226	0.202
Standardized mean household total net worth	132,368.8	178,928.0	137,915.3	159,248.0
Area of residence				
North	0.431	0.393	0.284	0.370
Centre	0.187	0.262	0.237	0.242
South	0.382	0.345	0.479	0.389
Type of area				

big city	0.081	0.061	0.074	0.068
suburbs or outskirts of a big city	0.057	0.061	0.121	0.077
large town	0.138	0.139	0.121	0.134
small town	0.228	0.222	0.137	0.199
rural area or village	0.496	0.516	0.547	0.521
% with other individuals present during the cognitive section in the first wave	0.902	0.698	0.684	0.731
% with other individuals present during the cognitive section in the second wave	0.886	0.703	0.684	0.731
N	123	374	190	687