Ageing & Society (2020), **40**, 2448–2479
doi:10.1017/S0144686X19000679

ARTICLE

The impact of wealth and income on the depression of older adults across European welfare regimes

Dimitrios Kourouklis[1], Georgia Verropoulou[2,3]* and Cleon Tsimbos[2]

[1]Center for Industrial Economics (CERNA), MINES ParisTech, Paris, France, [2]Department of Statistics & Insurance Science, University of Piraeus, Piraeus, Greece and [3]Centre for Longitudinal Studies, UCL Institute of Education, London, UK
*Corresponding author. Email: gverrop@unipi.gr

(Accepted 10 May 2019; first published online 20 June 2019)

Abstract
This paper examines the impact of wealth and income on the likelihood of depression among persons aged 50 or higher in four European regions characterised by differences in the standards of living and welfare systems. To address possible effects, data from Wave 6 of the Survey of Health, Ageing and Retirement in Europe (SHARE) have been used. Based on a sample of 60,864 persons resident in 16 European countries and a binary indicator of depression, probit and instrumental variable probit models were employed, the latter of which deal with issues of endogeneity and omitted variable bias. The findings show differences in the prevalence of depression across Europe, favouring the more affluent North/Western countries. Further, there is a difference in the role and the magnitude of the effect of income and wealth across different regions. First, though both measures exhibit a measurable effect, their impact is greater in the poorer Central/Eastern and Southern regions; this divide is more pronounced for wealth. Second, income seems to have a stronger effect compared to wealth in all instances: hence, it would seem that liquidity is more important among Europeans aged 50 or higher than assets. Nevertheless, neither income nor wealth are important among persons aged 65 or higher in Nordic countries which may be partly attributable to a more equitable welfare system.

Keywords: Europe; depression; income; wealth; welfare systems; Survey of Health, Ageing and Retirement in Europe (SHARE)

Introduction

Depression represents a worldwide burden; according to estimates by the World Health Organization (WHO), 322 million people suffered from the condition in 2015 (WHO, 2017*a*). Further, as often the onset is at an early age and episodes recur, it is considered a leading cause of Years Lived with Disability (Friedrich, 2017; WHO, 2017*a*), where its relative contribution over the past 25 years has been increasing (Ferrari *et al.*, 2013). Research has shown that it is prevalent

among older persons and it is strongly related to an increase in morbidity and mortality (Beekman *et al.*, 1999; Schultz *et al.*, 2000; Turvey *et al.*, 2009); it is also linked to a decline in quality of life and heavy utilisation of health-care services (D'Alisa *et al.*, 2006; Belloni *et al.*, 2016). As the numbers of persons aged 60 or higher are projected to increase substantially in the future (WHO, 2017*b*), pinpointing factors affecting their health and wellbeing becomes of ever-increasing importance, especially in Europe where the ageing process is more advanced compared to the other regions of the world. Such factors include socio-economic circumstances (*i.e.* income and wealth), which may form the basis for identifying vulnerable groups that should be aided by the implementation of appropriate policies.

The existence of a strong socio-economic gradient in depression is well documented (Lorant *et al.*, 2003, 2007; Muntaner, 2004; Hudson, 2005; Fiske *et al.*, 2009; Buber and Engelhardt, 2011). Abrupt changes, termed 'acute negative events', are often linked to depressive episodes (Ferraro and Shippee, 2009; Colman and Ataullahjan, 2010; Thoits, 2010). Among others, loss of income, which represents liquidity and the ability to respond instantly to needs, may predispose to depression, especially among older persons who, becoming pensioners, may face significant changes in their standards of living. Long-term exposure to stress is also known to trigger depression (Thoits, 2010). Low socio-economic status (SES) and financial strain over extended periods of time are potent stressors (Ferraro and Shippee, 2009; Colman and Ataullahjan, 2010). Wealth, which represents accumulation of resources over the lifecourse, reflects, up to a point, past socio-economic circumstances and may be the means to face financial and health adversities, especially among pensioners with low income (Christelis *et al.*, 2005). In fact, there are analyses suggesting that wealth is a more robust indicator of SES among persons aged 65 or higher than income (Shavers, 2007; Semyonov *et al.*, 2013). Nevertheless, past cross-sectional analyses of the association of SES with mental health are often hampered by the issue of reverse causality, as the relationship is reciprocal, with poor mental health affecting educational attainment, employment opportunities and earning power while, at the same time, facing financial hardship and deprivation may itself cause or precipitate the onset of depression (Mulatu and Schooler, 2002; Butterworth *et al.*, 2009; Golberstein, 2015).

In this context, the present study has three aims; the first aim is to appraise the importance of income, a measure of concurrent liquidity, *versus* wealth, which represents long-term financial resources, in predicting depression among older adults and pensioners in Europe, adding thus evidence in this debate, while using a method that takes into account the reciprocal association of SES and mental health. Analyses using an instrumental variable approach are scarce, focusing mainly on the population of the United States of America (USA), while they usually apply to specific sub-groups such as lottery winners, home-owners, *etc*. In this instance, however, the general population aged 50 or higher is considered, allowing us to reach concrete conclusions concerning older Europeans.

A second objective of the analysis is to compare relative effects between the younger and the older segment, *i.e.* persons aged 50–64 and those aged 65 or higher, as the latter group includes mainly pensioners for whom income may be less important compared to younger persons; further, retirement itself is known to have an effect on physical and mental health (Coe and Zamarro, 2011; Belloni *et al.*, 2016; Clouston

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

and Denier, 2017; Heller-Sahlgren, 2017). The third objective is to assess differentials across four European regions (Southern, Northern, Western and Central/Eastern) which are characterised by differences in depression levels, living standards, Gross Domestic Product (GDP), and health-care and welfare systems in order to establish whether individual SES has a greater effect in more deprived areas. To achieve that, data from the most recent round of the Survey of Health, Ageing and Retirement in Europe (SHARE Wave 6) have been used. Measurement of depression relies on 12 self-reported symptoms comprising the EURO-D scale (Prince *et al.*, 1999).

Background

Differentials across Europe

Past research reveals differences in depression levels across regions (WHO, 2017*a*). Considering Europe, findings based on the European Social Survey Wave 3, carried out in 2006/7, show that depression is more prevalent in Central/Eastern Europe as opposed to North/Western Europe (Van de Velde *et al.*, 2010). Other analyses concerning serious depressive symptoms, based on the European Social Survey 2014 data (Wave 7), also indicate a lower prevalence in Northern and Western regions and a higher prevalence in Central/Eastern and Southern regions (Huijts *et al.*, 2017), though Southern Europe in this instance is represented solely by Portugal. Regional differentials may be attributable to various factors, including differences in the standards of living and SES, as well as in the health-care and welfare systems (Eikemo *et al.*, 2008; Eurostat, 2014).

Europe is characterised by five different welfare systems, four of which are of interest in the present study: the Nordic, the Continental (or Bismarckian), the Mediterranean (or Southern) and the Central/Eastern (Fenger, 2007; Kemppainen, 2012; Ferrera and Rhodes, 2013; Popova and Kozhevnikova, 2013). Though all systems have common aims, namely the welfare of the population and the support of vulnerable groups, they exhibit marked differences. The Nordic model, implemented in Northern Europe (Norway, Sweden, Finland, Denmark and the Netherlands) is based on the principle of equity, allowing equal access to social and health-care services, education and culture. The Continental or Bismarckian model, implemented in Western Europe (Austria, France, Germany, Belgium and Luxembourg), provides high levels of public support, substantial unemployment benefits, disability pensions and health care of high quality. The Southern or the Mediterranean model (Italy, Spain, Greece and Portugal) leans heavily on the assumption that socially unprotected members should be, at least partly, supported by family but bestows generous pensions and incorporates a universal health-care system. The Central/Eastern European model (Poland, Bulgaria, Ukraine, the Czech Republic, Hungary, Slovakia and Estonia) applies redistribution to prevent poverty and presupposes a strong involvement and support from family; however, due to low state budgets and pensions there is a high risk of poverty among older persons. Further, standards of living in terms of per capita GDP differentiate between the above-mentioned regions of Europe. North/Western Europe includes the most affluent regions with per capita GDPs in 2015 ranging from around €33,000 in France to €91,500 in Luxemburg, followed by Southern European countries (with per capita GDPs

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

ranging from €16,300 in Greece to €27,000 in Italy) and, lastly, by Central/Eastern Europe (with per capita GDPs ranging from €10,600 in Croatia to €16,000 in the Czech Republic) (Eurostat, 2018).

SES and health based on an instrumental variable approach

A few studies have used an instrumental variable approach to explore the causal impact of wealth and income on health in order to avoid issues stemming from the endogeneity of income/wealth and health as well as from omitted variable bias (Ettner, 1996; Golberstein, 2015; Erixson, 2017). As instruments have to be plausibly exogenous and provide a source of variation at individual level, shock events influencing individual wealth and income in different ways are often exploited, including policy reforms, inheritance, stock market fluctuations, lottery winnings, *etc*. Findings in several cases indicate an effect of income and wealth on health, though some apply only on selected groups of people, for instance lottery winners, while the magnitude of the effects in some instances is minor or negligible. Ettner (1996) found a significant effect of income on both physical and mental health, exploiting various instruments, spousal and parental education among others, while Golberstein (2015), exploiting the Notch, which reflects a permanent, exogenous shock to Social Security income among retirees in the USA, finds a significant effect only on women's mental health. Atalay *et al.* (2017), exploiting house price increases, finds a positive effect of wealth on the physical health of home-owners and a negative effect on the health of renters in Australia. McInerney *et al.* (2013) exploited the variation in stock holdings caused by the 2008 US stock market crash and concluded that changes in wealth have a significant effect on the feeling of depression, dependent upon the extent of loss, but no effect on clinically validated depression measures. Schwandt (2018) exploited stock market shocks occurring over 1998–2011 in the USA and found a significant effect of wealth on the physical and mental health of a sample of retiree stockholders. On the other hand, Kim and Ruhm (2012) exploited inheritance shocks in the USA and found that wealth has virtually no effect on the health of older adults, while Erixson (2017) exploited inheritance tax reforms in Sweden and found only a short to medium run impact of wealth on objective health. Regarding research exploiting lottery winnings, Lindahl (2005) finds a positive effect of income due to lottery winnings on self-reported illness, strongest among older persons, while Gardner and Oswald (2007) as well as Apouey and Clark (2015) found that mental health improved among lottery winners in Great Britain. Though the findings of the method may not be entirely consistent, in some cases implying a tenuous association between SES and health whereas in other cases showing a significant effect, these apply mostly to the US population and to specific groups of persons and may be, thus, not applicable to the general or to the European population. Further, the settings of the above-mentioned studies differ regarding the choice of an appropriate instrument.

Data

The data used in the analysis come from SHARE, a multi-disciplinary panel survey collecting information on persons aged 50 or higher who are resident in various

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

European countries. The survey has been modelled on the Health and Retirement Survey of the USA and the English Longitudinal Survey of Ageing. Response rates are at levels comparable to other similar surveys such as the European Community Household Panel, European Labour Force Survey, European Social Survey, *etc.* (De Luca and Peracchi, 2005). Following the first wave of SHARE, the sample at successive waves includes both respondents from previous waves (longitudinal sample) as well as a refresher sample. Individual response rates at Wave 6 range from 74.3 per cent (Luxembourg) to 95.7 per cent (Croatia) for the refresher sample, while retention rates between Waves 5 and 6 for the longitudinal sample range from 69.6 per cent (Luxembourg) to 79.6 per cent (Denmark) (Bergmann *et al.*, 2017). The specifics of the survey have been presented in detail elsewhere (Börsch-Supan *et al.*, 2013).

Sample

Wave 6 of SHARE was carried out in 2015; 17 countries participated, ranging from Northern to Southern to Eastern Europe: Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Greece, Italy, Luxembourg, Poland, Portugal, Spain, Sweden, Switzerland and Slovenia. The relevant data were first released in March 2017 (release 6.0.0) but the more recent release 6.1.0 data (in March 2018) are used in the study (Börsch-Supan, 2017). The analysis focuses on the 16 countries considered to adequately represent the Southern, Western (or Bismarckian), Central/Eastern and Northern European welfare systems, grouped as follows: (a) Southern: Greece, Italy, Portugal and Spain, (b) Western: Austria, Belgium, France, Germany and Luxembourg, (c) Central/Eastern: Croatia, Czech Republic, Estonia, Poland and Slovenia; and (d) Northern: Denmark and Sweden. Similar categorisations have been used in past analyses (Eikemo *et al.*, 2008). The overall sample size corresponding to these countries was 62,554 persons. Proxy interviews (1,106 cases or 1.71%) were excluded from the sample, as were persons with missing information regarding proxy interview status (584 cases or 0.93%). Hence, 60,864 persons were retained in the analysis.

Outcome variable

The dependent variable of the analysis is depression measured by the EURO-D scale, comprising 12 items which represent symptoms; these include depression, pessimism, suicidality, guilt, sleep, lack of interest, irritability, appetite, fatigue, lack of concentration, lack of enjoyment and tearfulness (Prince *et al.*, 1999). The outcome variable has been used in binary form, distinguishing between persons with no depression (*i.e.* exhibiting fewer than four symptoms) and those who have depression (at least four symptoms). This cut-off point has been validated psychometrically against several clinically relevant indicators at the EURODEP study (Dewey and Prince, 2005) as well as in numerous analyses in the past (Castro-Costa *et al.*, 2007, 2008; Courtin *et al.*, 2015). Further, sensitivity analysis performed using different thresholds (three, five and six depressive symptoms) indicated that the findings of the present study are robust and not affected by the choice of the cut-off point (*see* the 'Robustness of findings' section).

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Independent variables

Wealth and income

The explanatory variables of interest include household net wealth and household income in euros. Household net wealth is a composite measure including financial assets, bank accounts, mortgages, bank deposits, stock holdings, bonds, mutual funds, life insurance policies and individual retirement accounts. Household income denotes the overall income of the household members in the year preceding the survey. In the present analysis the imputed variables provided by the SHARE team (first data-set; implicat = 1) have been used (for information on the imputation procedure, *see* SHARE release guide 6.1.0, 2018); the findings based on the remaining four imputed data-sets as well as on the combined five data-sets are discussed in the 'Robustness of findings' section.

Both variables were first purchasing power parity adjusted to become comparable across countries and welfare systems. Subsequently, as they exhibited a wide range and extreme values they were transformed using their natural logarithm. Prior to this transformation, zero values for income (reported by 1,176 respondents or 1.9% of the sample) where recoded to €1, as the natural logarithm of zero is undefined; further, wealth was treated in a similar manner for reported values below €1 (2,742 respondents or 4.5% of the sample). This treatment was carried out in order to retain in the sample the more disadvantaged respondents (those with no income and those reporting no wealth or being in debt) who also exhibited a higher likelihood of depression.

Socio-demographic characteristics and morbidity

All models control for age of the respondents in years as well as age squared, in order to capture the nonlinear effect of age on depression. Further, gender, educational attainment in years and country of residence have also been included in the models. Morbidity is represented by two binary indicators: having reported at least two chronic diseases out of a list of 21 conditions and being limited in activities, based on the Global Activity Limitations Indicator which represents both activity restrictions and functional limitations in European populations (Berger *et al.*, 2015).

Instrumental variable

As instrumental variable the educational attainment (years of education) of the partner of the respondent has been used (for rationale, *see* the Methods section). For unpartnered respondents (27.6% of the sample) the variable was coded as 0, retaining thus a substantial segment of the sample in the analysis while, at the same time stating that there was no contribution to income or wealth related to partner's education.

Methods

For quantifying the causal impact of household income and household wealth on the probability of having depression, a sequence of probit and instrumental variable (IV) probit models is employed. Moreover, the analysis takes into consideration two different econometric models, each of which includes a different main

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

explanatory variable. These models were run separately for four, broadly defined, European regions while, apart from considering all ages together, estimates are provided for two broad age groups, 50–64 and 65+, using the most common official retirement age in Europe as a benchmark. The analysis has been carried out using Stata version 13.

Probit model

Due to the dichotomous nature of our dependent variable, we investigate the impact of wealth and income on depression by estimating a probit specification.

As already mentioned, the binary outcome variable (Eurodcat) is based on the Euro-D scale, which reflects the existence or absence of 12 self-reported symptoms. Let W and I represent wealth and income, respectively, whereas X is a vector of variables which represents other characteristics controlled for, regarding the survey participant i, resident in European region r in the period t that the wave was conducted. We also controlled for country of residence employing dummies (λ_c) and clustered standard errors at the household level, accounting thus for the presence of more than one person in a household.

$$\text{EuroD}_{irt} = W_{irt}\beta + X_{irt}\delta + \lambda_c + \varepsilon_{irt}$$

$$\text{EuroD}_{irt} = I_{irt}\beta + X_{irt}\delta + \lambda_c + \varepsilon_{irt}.$$

The outcome variable is built based on a specific cut-off point, which assigns the value 1 when the EURO-D scale > 3 and the value 0 otherwise.

$$\text{Eurodcat}_{irt} = 0, \text{ if } \text{EuroD}_{irt} \leq 3$$

$$\text{Eurodcat}_{irt} = 1, \text{ if} \text{EuroD}_{irt} > 3.$$

Hence, probit estimates are based on the following latent models which estimate the probability that a person suffers from depression:

$$\Pr[\text{Eurodcat}_{irt} = 1|X_{irt}] = \text{EuroD}_{irt} > 3 = \Pr[W_{irt}\beta + X_{irt}\delta + \lambda_c + \varepsilon_{irt} > 3|X_{irt}]$$

$$\Pr[\text{Eurodcat}_{irt} = 1|X_{irt}] = \text{EuroD}_{irt} > 3 = \Pr[I_{irt}\beta + X_{irt}\delta + \lambda_c + \varepsilon_{irt} > 3|X_{irt}].$$

By taking into consideration the independence and normal distribution of the error terms, the impact of wealth and income on the probability that a respondent suffers from depression is estimated. In other words, the probability of having depression is calculated as a function of wealth (or income) while controlling for the above-mentioned characteristics of a respondent, using the probit model.

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

IV probit identification strategy

There are two sources of possible bias which may result in the endogeneity of both wealth and income in relation to depression. These sources include omitted variable bias as well as simultaneity bias (or reverse causality). Omitted variable bias occurs when there are unobserved variables affecting both wealth and depression or income and depression. For instance, any inherited mental health disorder or co-residing with adult children may produce such effects (Courtin and Avendano, 2016). Moreover, differences in health-care systems may affect the wealth and/or income of a household (through medical expenses, out-of-pocket payments, *etc.*) while, at the same time, they may have a direct impact on depression. Another case of omitted variable bias could arise from the impact that health systems have on managing chronic diseases through priority settings. Similarly, decisions on formulating policies related to out-of-pocket payments for health care, social and health insurance contributions, as well as co-insurance rates would affect both the income and the wealth of a household considerably, as well as the probability of depression (Kim and Yang, 2011; Arsenijevic *et al.*, 2013; Ubel *et al.*, 2013; Pan and Sambamoorthi, 2015). Simultaneity bias is also considered, firstly because poor mental health affects wealth and/or income by increasing expenditure for medications (Gadit, 2004; Harman *et al.*, 2004; Fullerton *et al.*, 2011) and, secondly, persons who are still employed may experience income reduction as those who suffer from depression might not be productive or able to work (Dewa and Lin, 2000; Lerner and Henke, 2008; Woo *et al.*, 2011).

Hence, to minimise effects of such biases, an instrumental variable approach is used. For the identification strategy used in the present setting, we exploit the years of partner's education, and thus variability between people, creating plausible exogenous variations in wealth and income. In Figure 1, we show the variation of this instrument across countries.

A proper instrument has to satisfy the following conditions. Firstly, it must be correlated with the endogenous independent variable and thus the first-stage *F*-statistic must be above 10 so that the instrument is not weak (Staiger and Stock, 1997; Stock *et al.*, 2002). Secondly, it should be uncorrelated with the error term. With regard to the first requirement, we show the relevance of the instrument statistically in the Results section through the first-stage *F*-statistic. We mainly support this theoretically by considering a highly cited paper by Ettner (1996), which notes the correlation between spousal education and household income. Another argument related to the relevance of our instrument is generated by evidence showing that partner's education is correlated with earnings and this is attributable, mainly, to the cross-productivity between partners (Huang *et al.*, 2009). Other research examining the impact of financial literacy, which can act as indicator of education, on household wealth finds a positive effect on household net worth and its determinants (Van Rooij *et al.*, 2012). Further, the instrument proposed for financial literacy is the educational attainment of relatives (*i.e.* parents and siblings) (Van Rooij *et al.*, 2011, 2012). Moreover, financial education stimulates savings and asset accumulation in general (Bernheim and Garrett, 2003). All this evidence allows us to conclude that household wealth and income can be increased due to partner's education, and therefore the relevance criterion is fulfilled.

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

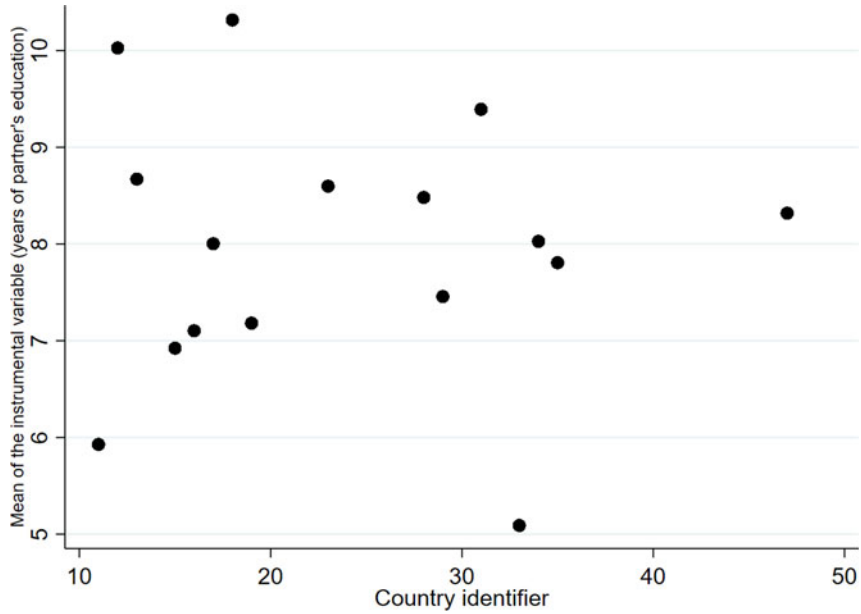

Figure 1. Variation of mean values of the instrumental variable by country.
Notes: In order to construct this graph, the following numerical values were assigned to our sample's countries. Austria: 11, Germany: 12, Sweden: 13, Spain: 15, Italy: 16, France: 17, Denmark: 18, Greece: 19, Belgium: 23, Czech Republic: 28, Poland: 29, Luxembourg: 31, Portugal: 33, Slovenia: 34, Estonia: 35, Croatia: 47.

As mentioned earlier, the second condition for a valid instrumental variable identification strategy has to do with the validity of the instrument. The orthogonality of the instrument to the error term requirement presupposes that the instrument is exogenous with respect to the dependent variable. More specifically, the years of partner's education should not be correlated with the respondent's depressive symptoms but may affect the latter only through income and wealth. Though the assortative mating theory (Huang *et al.*, 2009) suggests that there is a positive correlation between partners' educational attainment, this is at best weak in the present study (correlation coefficient = 0.11) and this also holds regarding the association of partner's years of education with the respondent's depressive symptoms (correlation coefficient = −0.15). Hence, years of partner's education may be considered a valid instrument, a fact reinforced by the findings of the Hansen *J* Test of orthogonality (Hansen *et al.*, 2008) (*see* the 'Robustness of findings' section).

In this paper, the first-stage regressions are presented below:

$$W_{irt} = Z_{irt}\tau + X_{irt}\delta + \lambda_c + \varepsilon_{irt}$$

$$I_{irt} = Z_{irt}\tau + X_{irt}\delta + \lambda_c + \varepsilon_{irt}.$$

The second stage of the investigated IV probit estimations is:

$$\Pr[\text{Eurodcat}_{irt}|X_{irt}] = \Pr[Z_{irt}\beta + X_{irt}\delta + \lambda_c + \varepsilon_{irt}|X_{irt}],$$

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

$$\{\text{Eurodcat} \in \mathbb{Z},\ \text{Eurodcat} \in [0, 1]\}.$$

where Eurodcat is the depression binary dependent variable, Z symbolises the instrumental variable, X is a vector of control variables, λ_c is the country of residence, W and I are the wealth and the income of the household, respectively, and ϵ is the error term.

Results

In Table 1, descriptive statistics for the variables used in the analysis are displayed. Overall, 27.94 per cent of the sample exhibits at least four symptoms of depression. Levels differentiate across European regions; prevalence seems highest in Southern Europe (31.60%), followed closely by Central/Eastern Europe (29.36%) and Western Europe (27.49%); Northern Europe exhibits markedly low levels (17.45%). Substantial differences across regions can also be observed regarding median and mean household wealth and income. Western Europeans represent the most affluent group. Northern Europeans follow closely, having 97.5 per cent of the Western Europeans' wealth and 88.0 per cent of their mean income while Southern and Central/Eastern European are more disadvantaged; South Europeans have 57.8 per cent of Western Europeans' wealth and 45.5 per cent of their mean income while Central/East Europeans have 41.2 per cent of the Western Europeans' wealth and 38,2 per cent of their mean income. Differences based on median values are of a similar extent, except regarding net wealth for South and North Europeans the gap is slightly narrower. As far as the instrument is concerned (years of partner's education), there are substantial differences between regions with Northern Europeans exhibiting the highest mean and median values (9.5 and 11 years, respectively), Western and Central/Eastern Europeans following closely (mean 8.1–8.4 years, median 10 years), while South Europeans record the lowest values (mean 6.9 years, median 6 years).

The estimates of the models are presented in Tables 2–5, using first household wealth as the main independent variable and, subsequently, household income. In all cases, the first stage F-statistic of the instrument, years of partner's education, exceeds the rule-of-thumb that the F-statistic should be at least 10, and therefore the above-mentioned instrument is not weak. Moreover, in order to test the orthogonality of the instrument we performed the Hansen J Test (Hansen *et al.*, 2008), including both the instrument used in the 'Robustness of findings' section along with partner's years of education. In all cases, the p-value is greater than 0.10, and therefore our instrument is valid. Additionally, the Wald test of exogeneity of the instrumented variables reported in the tables rejects the null hypothesis of no endogeneity.

Household wealth and depression

Estimates for all countries for the whole sample and by broad age group are presented in Table 2. The coefficients based on the probit models severely underestimate the relative effect of wealth on depression compared to the instrumental

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Table 1. Descriptive statistics of the main variables of interest (percentages and median values) by welfare system

	Dependent variable: depression (%)	Independent variables		Instrument: years of partner's education
		Wealth	Income	
All systems (N = 60,864):				
Median		126,974.7	16,518.76	9
Mean	27.94	212,362.1	23,265.06	8.01
Coefficient of variation	0.016	1.592	1.279	0.767
Southern Europe (N = 16,522):				
Median		125,477.5	13,065.2	6
Mean	31.6	174,029.9	16,281.32	6.87
Coefficient of variation	0.015	1.205	1.067	0.811
Western Europe (N = 18,479)				
Median		197,127.9	25,863.25	10
Mean	27.49	300,924.4	35,772.66	8.39
Coefficient of variation	0.016	1.594	1.255	0.772
Central/Eastern Europe (N = 18,419):				
Median		78,778.45	11,230.37	10
Mean	29.36	123,992.0	13,654.73	8.06
Coefficient of variation	0.016	1.543	0.900	0.742
Northern Europe (N = 7,444):				
Median		184,065.4	26,965.74	11
Mean	17.45	293,472.6	31,495.74	9.46
Coefficient of variation	0.022	1.221	0.637	0.681

Note: The data are retrieved from the Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 6 and refer to information gathered from 16 countries divided into four groups based on their welfare system: (a) Southern Europe: Greece, Italy, Portugal and Spain; (b) Western Europe: Austria, Belgium, France, Germany and Luxembourg; (c) Central/East Europe: Croatia, Czech Republic, Estonia, Poland and Slovenia; and (d) Northern Europe: Denmark and Sweden.

variable approach, though effects point to the same direction; more specifically, the coefficient of the probit model is one-third of the coefficient of the IV probit model. This could be related to the fact that the IV probit model corrects the upward bias of measurement errors in the perceived depression, as well as the bias arising from reverse causality and omitted variables. Increasing age is linked to a decreasing likelihood of depression; the rate of decline is weaker among older respondents. The odds of depression are substantially lower for men compared to women while higher educational attainment has a significant protective effect. Chances of

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Table 2. Effects of household wealth on depression (all countries)

	All countries	
Variables	Probit	IV probit
All ages:		
Log wealth$_{irt}$	−0.0342***	−0.1087***
Years of education$_{irt}$	−0.0156***	−0.0073***
Limitation with activities$_{irt}$	0.5959***	0.5648***
At least two chronic diseases$_{irt}$	0.3371***	0.3224***
Age$_{irt}$	−0.0975***	−0.0739***
Age$^2_{irt}$	0.0007***	0.0005***
Gender$_{irt}$	0.4038***	0.3901***
First-stage *F*-statistic	$F(1, 60{,}841) = 2{,}657.38$	
Wald test of exogeneity	$\chi^2(1) = 64.60$, $p = 0.000$	
Observations (N)	60,864	
Age 50–64:		
Log wealth$_{irt}$	−0.0412***	−0.1218***
Years of education$_{irt}$	−0.0151***	−0.0046
Limitation with activities$_{irt}$	0.5513***	0.5114***
At least two chronic diseases$_{irt}$	0.3911***	0.3683***
Age$_{irt}$	0.0178	0.0301
Age$^2_{irt}$	−0.0003	−0.0003
Gender$_{irt}$	0.4027***	0.4116***
First-stage *F*-statistic	$F(1, 25{,}287) = 1{,}096.26$	
Wald test of exogeneity	$\chi^2(1) = 37.39$, $p = 0.000$	
Observations (N)	25,310	
Age 65+:		
Log wealth$_{irt}$	−0.0283***	−0.0994***
Years of education$_{irt}$	−0.0145***	−0.0072***
Limitation with activities$_{irt}$	0.6207***	0.5949***
At least two chronic diseases$_{irt}$	0.2981***	0.2887***
Age$_{irt}$	−0.0478**	−0.0260
Age$^2_{irt}$	0.0003***	0.0002*
Gender$_{irt}$	0.4117***	0.3844***
First-stage *F*-statistic	$F(1, 35{,}531) = 1{,}575.30$	
Wald test of exogeneity	$\chi^2(1) = 28.20$, $p = 0.000$	
Observations (N)	35,554	

Notes: The dependent variable is depression in binary format (Eurodcat). Standard errors are robust to arbitrary heteroscedasticity and corrected for clustering at the household level. The instrument which is used for the instrumental variable (IV) probit estimation is: years of partner's education. Model additionally controls for country of residence. All predictors refer to the respondent.
Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Table 3. Effects of household wealth on depression (by welfare system)

	Southern Europe		Western Europe		Central/Eastern Europe		Nordic	
Variables	Probit	IV probit	Probit	IV probit	Probit	IV probit	Probit	IV probit
All ages:								
Log wealth$_{irt}$	−0.0369***	−0.1555***	−0.0361***	−0.0818***	−0.0301***	−0.1306***	−0.0395***	−0.0814***
Years of education$_{irt}$	−0.0152***	−0.0048	−0.0113***	−0.0064**	−0.0273***	−0.0097**	0.0080	0.0131**
Limitation with activities$_{irt}$	0.6417***	0.6036***	0.5869***	0.5652***	0.5453***	0.5119***	0.5804***	0.5533***
At least two chronic diseases$_{irt}$	0.3901***	0.3796***	0.3146***	0.2955***	0.3356***	0.3280***	0.2841***	0.2734***
Age$_{irt}$	−0.1058***	−0.0677***	−0.0969***	−0.0811***	−0.0663***	−0.0327**	−0.1679***	−0.1596***
Age$^2_{irt}$	0.0007***	0.0005***	0.0006***	0.0005***	0.0005***	0.0002**	0.0011***	0.0011***
Gender$_{irt}$	0.4428***	0.4400***	0.4271***	0.4214***	0.3499***	0.3193***	0.3818***	0.3697***
First-stage *F*-statistic	$F(1, 16{,}511) = 400.56$		$F(1, 18{,}467) = 1{,}064.99$		$F(1, 18{,}407) = 768.05$		$F(1, 7{,}435) = 426.42$	
Wald test of exogeneity	$\chi^2(1) = 25.41$, $p = 0.000$		$\chi^2(1) = 9.48$, $p = 0.002$		$\chi^2(1) = 35.66$, $p = 0.000$		$\chi^2(1) = 2.79$, $p = 0.095$	
Observations (N)	16,522		18,479		18,419		7,444	
Age 50–64:								
Log wealth$_{irt}$	−0.0406***	−0.1643***	−0.0379***	−0.0756***	−0.0443***	−0.1704***	−0.0450***	−0.1103***
Years of education$_{irt}$	−0.0181***	−0.0043	−0.0095**	−0.0051	−0.0250***	−0.0017	0.0031	0.0133
Limitation with activities$_{irt}$	0.6370***	0.5874***	0.5327***	0.5112***	0.4971***	0.4523***	0.5686***	0.5178***
At least two chronic diseases$_{irt}$	0.4438***	0.4256***	0.3740***	0.3541***	0.3898***	0.3770***	0.3474***	0.3196***
Age$_{irt}$	−0.0834	−0.0171	0.0544	0.0599	0.0793	0.0276	0.1045	0.1466
Age$^2_{irt}$	0.0005	0.0001	−0.0007	−0.0007	−0.0007	−0.0002	−0.0011	−0.0015
Gender$_{irt}$	0.4341***	0.4669***	0.4475***	0.4531***	0.3243***	0.3279***	0.3958***	0.3850***
First-stage *F*-statistic	$F(1, 6{,}684) = 171.68$		$F(1, 8{,}085) = 463.48$		$F(1, 7{,}692) = 309.47$		$F(1, 2{,}805) = 167.35$	

Wald test of exogeneity	$\chi^2(1) = 14.20$, $p = 0.000$		$\chi^2(1) = 3.49$, $p = 0.061$		$\chi^2(1) = 24.22$, $p = 0.000$		$\chi^2(1) = 3.71$, $p = 0.053$	
Observations (N)	6,695		8,097		7,704		2,814	
Age 65+:								
Log wealth$_{irt}$	−0.0331***	−0.1513***	−0.0341***	−0.0937***	−0.0201***	−0.1029***	−0.0345***	−0.0581
Years of education$_{irt}$	−0.0128***	−0.0047	−0.0134***	−0.0077*	−0.0272***	−0.0136**	0.0110*	0.0135*
Limitation with activities$_{irt}$	0.6491***	0.6166***	0.6298***	0.6062***	0.5786***	0.5506***	0.5835***	0.5702***
At least two chronic diseases$_{irt}$	0.3582***	0.3538***	0.2655***	0.2461***	0.2988***	0.2956***	0.2445***	0.2407***
Age$_{irt}$	−0.0864**	−0.0823**	−0.0149	0.0070	−0.0418	−0.0095	−0.0739	−0.0697
Age$^2_{irt}$	0.0006**	0.0004**	0.0001***	−0.00002	0.0003	0.0001	0.0005	0.0005
Gender$_{irt}$	0.4501***	0.4244***	0.4155***	0.3946***	0.3765***	0.3304***	0.3827***	0.3738***
First-stage *F*-statistic	$F(1, 9{,}816) = 237.48$		$F(1, 10{,}370) = 621.76$		$F(1, 10{,}703) = 441.27$		$F(1, 4{,}621) = 256.87$	
Wald test of exogeneity	$\chi^2(1) = 11.41$, $p = 0.000$		$\chi^2(1) = 7.29$, $p = 0.006$		$\chi^2(1) = 12.69$, $p = 0.000$		$\chi^2(1) = 0.40$, $p = 0.524$	
Observations (N)	9,827		10,382		10,715		4,630	

Notes: The dependent variable is depression in binary format (Eurodcat). Standard errors are robust to arbitrary heteroscedasticity and corrected for clustering at the household level. The instrument which is used for the instrumental variable (IV) probit estimation is: years of partner's education. All predictors refer to the respondent.
Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Effects of household income on depression (all countries)

	All countries	
Variables	Probit	IV probit
All ages:		
Log income$_{irt}$	−0.0412***	−0.2029***
Years of education$_{irt}$	−0.0179***	−0.0113***
Limitation with activities$_{irt}$	0.6060***	0.5941***
At least two chronic diseases$_{irt}$	0.3439***	0.3459***
Age$_{irt}$	−0.1044***	−0.0872***
Age$^2_{irt}$	0.0007***	0.0006***
Gender$_{irt}$	0.4031***	0.3803***
First-stage *F*-statistic	$F(1, 60{,}841) = 2{,}804.60$	
Wald test of exogeneity	$\chi^2(1) = 89.35$, $p = 0.000$	
Observations (N)	60,864	
Age 50–64:		
Log income$_{irt}$	−0.0363***	−0.2167***
Years of education$_{irt}$	−0.0188***	−0.0086***
Limitation with activities$_{irt}$	0.5657***	0.5464***
At least two chronic diseases$_{irt}$	0.4019***	0.4046***
Age$_{irt}$	0.0066	−0.0255
Age$^2_{irt}$	−0.0002	0.00006
Gender$_{irt}$	0.3940***	0.3919***
First-stage *F*-statistic	$F(1, 25{,}287) = 1{,}074.37$	
Wald test of exogeneity	$\chi^2(1) = 61.17$, $p = 0.000$	
Observations (N)	25,310	
Age 65+:		
Log income$_{irt}$	−0.0533***	−0.1917***
Years of education$_{irt}$	−0.0157***	−0.0108***
Limitation with activities$_{irt}$	0.6275***	0.6185***
At least two chronic diseases$_{irt}$	0.3021***	0.3033***
Age$_{irt}$	−0.0534***	−0.0432**
Age$^2_{irt}$	0.0004***	0.0003**
Gender$_{irt}$	0.4104***	0.3792***
First-stage *F*-statistic	$F(1, 35{,}531) = 2{,}102.86$	
Wald test of exogeneity	$\chi^2(1) = 29.25$, $p = 0.000$	
Observations (N)	35,554	

Notes: The dependent variable is depression in binary format (Eurodcat). Standard errors are robust to arbitrary heteroscedasticity and corrected for clustering at the household level. The instrument which is used for the instrumental variable (IV) probit estimation is: years of partner's education. All predictors refer to the respondent.
Significance levels: ** $p < 0.05$, *** $p < 0.01$.

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Table 5. Effects of household income on depression (by welfare system)

	Southern Europe		Western Europe		Central/Eastern Europe		Nordic	
Variables	Probit	IV probit	Probit	IV probit	Probit	IV probit	Probit	IV probit
All ages:								
Log income$_{irt}$	−0.0401***	−0.2318***	−0.0763***	−0.1772***	−0.0375***	−0.2139***	−0.0816***	−0.1893***
Years of education$_{irt}$	−0.0167***	−0.0077**	−0.0124***	−0.0085***	−0.0307***	−0.0209***	0.0052	0.0088*
Limitation with activities$_{irt}$	0.6522***	0.6443***	0.5940***	0.5818***	0.5515***	0.5418***	0.5961***	0.5843***
At least two chronic diseases$_{irt}$	0.3957***	0.4113***	0.3251***	0.3191***	0.3387***	0.3433***	0.2926***	0.2897***
Age$_{irt}$	−0.1099***	−0.0691***	−0.1064***	−0.1020***	−0.0719***	−0.0492***	−0.1779***	−0.1809***
Age$^2_{irt}$	0.0008***	0.0005***	0.0007***	0.0006***	0.0005***	0.0003***	0.0012***	0.0012***
Gender$_{irt}$	0.4386***	0.4166***	0.4190***	0.4044***	0.3534***	0.3309***	0.3789***	0.3611***
First-stage *F*-statistic	$F(1, 16{,}511) = 236.19$		$F(1, 18{,}467) = 2{,}442.39$		$F(1, 18{,}407) = 1{,}438.07$		$F(1, 7{,}435) = 1{,}492.20$	
Wald test of exogeneity	$\chi^2(1) = 29.86$, $p = 0.000$		$\chi^2(1) = 10.77$, $p = 0.001$		$\chi^2(1) = 43.64$, $p = 0.000$		$\chi^2(1) = 4.34$, $p = 0.037$	
Observations (N)	16,522		18,479		18,419		7,444	
Age 50–64:								
Log income$_{irt}$	−0.0376***	−0.2131***	−0.0470***	−0.1672***	−0.0260***	−0.2564***	−0.0959**	−0.2899***
Years of education$_{irt}$	−0.0199***	−0.0067	−0.0125***	−0.0076*	−0.0322***	−0.0169***	−0.0012	0.0061
Limitation with activities$_{irt}$	0.6520***	0.6416***	0.5463***	0.5275***	0.5067***	0.4923***	0.5843***	0.5544***
At least two chronic diseases$_{irt}$	0.4526***	0.4720***	0.3887***	0.3792***	0.3940***	0.4057***	0.3661***	0.3601***
Age$_{irt}$	−0.1059	−0.1308	0.0430	0.0268	0.0912	0.0162	0.0837	0.1064
Age$^2_{irt}$	0.0007	0.0009	−0.0006	−0.0004	−0.0008	−0.0001	−0.0010	−0.0012

(*Continued*)

Table 5. (*Continued.*)

	Southern Europe		Western Europe		Central/Eastern Europe		Nordic	
Variables	Probit	IV probit	Probit	IV probit	Probit	IV probit	Probit	IV probit
$Gender_{irt}$	0.4215***	0.4240***	0.4347***	0.4254***	0.3207***	0.3375***	0.3941***	0.3790***
First-stage *F*-statistic	$F(1, 6{,}684) = 128.43$		$F(1, 8{,}085) = 792.02$		$F(1, 7{,}692) = 439.41$		$F(1, 2{,}805) = 434.83$	
Wald test of exogeneity	$\chi^2(1) = 16.95$, $p = 0.000$		$\chi^2(1) = 8.19$, $p = 0.004$		$\chi^2(1) = 37.86$, $p = 0.000$		$\chi^2(1) = 5.71$, $p = 0.016$	
Observations (N)	6,695		8,097		7,704		2,814	
Age 65+:								
$Log\ income_{irt}$	−0.0424***	−0.2580***	−0.1130***	−0.1998***	−0.0584***	−0.1789***	−0.0691*	−0.1228
$Years\ of\ education_{irt}$	−0.0141***	−0.0082**	−0.0128***	−0.0097**	−0.0276***	−0.0214***	0.0092	0.0108*
$Limitation\ with\ activities_{irt}$	0.6568***	0.6496***	0.6326***	0.6248***	0.5823***	0.5754***	0.5978***	0.5930***
$At\ least\ two\ chronic\ diseases_{irt}$	0.3608***	0.3730***	0.2729***	0.2690***	0.3014***	0.3043***	0.2477***	0.2467***
Age_{irt}	−0.0860**	−0.0305	−0.0270	−0.0257	−0.0490	−0.0480	−0.0860	−0.0883
Age^2_{irt}	0.0006**	0.0002	0.0002	0.0001	0.0004	0.0003	0.0006*	0.0006*
$Gender_{irt}$	0.4483***	0.4044***	0.4045***	0.3872***	0.3721***	0.3393***	0.3805***	0.3688***
First-stage *F*-statistic	$F(1, 9{,}816) = 114.78$		$F(1, 10{,}370) = 1{,}143.59$		$F(1, 10{,}703) = 1{,}700.41$		$F(1, 4{,}618) = 1{,}180.68$	
Wald test of exogeneity	$\chi^2(1) = 13.04$, $p = 0.000$		$\chi^2(1) = 3.67$, $p = 0.055$		$\chi^2(1) = 9.71$, $p = 0.001$		$\chi^2(1) = 0.63$, $p = 0.427$	
Observations (N)	9,827		10,382		10,715		4,630	

Notes: The dependent variable is depression in binary format (Eurodcat). Standard errors are robust to arbitrary heteroscedasticity and corrected for clustering at the household level. The instrument which is used for the instrumental variable (IV) probit estimation is: years of partner's education. All predictors refer to the respondent.
Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

depression are 32 per cent higher for respondents reporting at least two chronic conditions and 56 per cent higher for those experiencing limitations in activities. Regarding the findings for the different age groups, again, the effects of wealth on depression are underestimated by the probit compared to the IV probit models. Further, the relative effect of wealth is greater among respondents aged 50–64 compared to their older counterparts. Most of the other factors exhibit associations similar to the overall model, except for educational attainment which is non-significant among younger persons and age which is not significant for both age groups.

Table 3 shows estimates by region of residence, for the whole sample and by broad age group. Regarding all age groups, the effect of wealth is significant for all regions but greater in Southern and Central/Eastern Europe, nearly double, compared to Western and Northern Europe. The effects of the control variables are analogous to those described for the total model. Among persons aged 50–64 again the relative effect is more marked for Southern and Central/Eastern Europeans while among older respondents it is more substantial for Southern Europeans and non-significant in Nordic countries. Regarding differences between these age groups by region, wealth seems more important among younger respondents, particularly in Central/Eastern and Northern Europe. The respective difference for Southern Europeans is minute while wealth is more important among persons aged 65 or higher in Western Europe.

Household income and depression

Table 4 shows estimates of the effect of income on depression for all countries, for the whole sample and by broad age group. The coefficients based on the probit models underestimate the relative effect of income more strongly than for wealth compared to the instrumental variable approach. More specifically, the coefficients of the probit models are about one-fifth of the respective coefficients of the IV probit model. This underestimation is somewhat more pronounced among younger respondents. Control variables exhibit similar associations as for wealth. Regarding the different age groups, the relative effect of income is somewhat greater among respondents aged 50–64 compared to their older counterparts but the gap is narrower compared to wealth. Most of the other factors exhibit associations similar to the overall model, except for age which is non-significant among younger respondents.

Regarding the estimates referring to the different European regions (Table 5), they exhibit an inverse association between income and depression, significant at the 1 per cent level in all instances with the exception of older respondents in Nordic regions. The model that refers to all ages indicates that income has a greater impact in Southern Europe, followed closely by Central/Eastern, Northern and Western Europe. The relative effect of income is greater compared to wealth in all regions but the difference is wider in Northern and Western Europe, where the coefficients for income indicate double the effect of wealth. Regarding the estimates for the different age groups, income among younger respondents has a greater effect in Northern regions, followed by Central/Eastern and Southern

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Europe, while among older respondents the greatest effect is observed in Southern Europe, followed by Western and Central/Eastern Europe.

Comparing the relative effect between age groups by region, for Southern and Western Europeans the effect of income on depression is more marked among persons aged 65 or higher, while among Central/Eastern and Northern Europeans the opposite holds. In particular, among Northern Europeans the effect for younger persons is more pronounced compared to all other areas while it is non-significant for persons aged 65 or higher.

Robustness of findings

In this part, we conduct robustness checks for our main estimates. As the empirical strategy is based on instrumental variables there may be several issues raised, such as the fulfilment of the instrument's orthogonality to the error term criterion. Thus, we cannot claim that our selected instrument is the only one which is appropriate for such analyses.

The instrument of stock market fluctuations as source of variation in wealth and income has been proposed in relevant literature (amongst others, McInerney *et al.*, 2013; Erixson, 2017; Schwandt, 2018). Therefore, we estimate the effects of household wealth and income on depression with the interest/dividends from bank accounts, bonds, stocks and mutual funds serving as the instrument. The findings based on this instrument are presented in Table 6 and refer to the total sample. The estimates of the main variables of interest, including sign and significance in most instances, seem robust. However, some differences can be observed. Firstly, in Panel A, the effect of wealth on depression for all ages underestimates the respective effect in Table 2 by 50 per cent. By contrast, in Panel B the effect of income on depression for respondents aged 65+ seems to be higher by 50 per cent compared to the estimate for this category, presented in Table 4. Further, the robustness check estimates indicate a non-significant relationship between wealth and depression as well as income and depression for persons aged 50–64. Nevertheless, the control variables estimates are robust and the instrument is not weak, because in all cases, the first-stage F-statistic exceeds the benchmark of $F > 10$ (Staiger and Stock, 1997; Stock *et al.*, 2002). In addition, we used this instrument as a second instrument to our main analyses to perform the Hansen J Test of over-identification restrictions (Hansen *et al.*, 2008). In all cases, the p-value is greater than 0.10 (it varies between 0.25 and 0.57), which indicates that we cannot reject the hypothesis of joint validity of the instruments. Therefore, this shows statistically that the instrument used in the main two-stage least squares estimations is valid.

The sensitivity of our findings was also examined for different cut-off points of the EURO-D scale (Tables 7 and 8). Table 7 provides estimates for the total sample when three, five and six symptoms of depression are used as a threshold. Table 8 presents estimates for a cut-off point of three symptoms across European regions. The findings for the different cut-off points suggest that the estimates of our main models are robust and consistent though, as expected, the magnitude of the relative effects of wealth and income differ slightly; as the number of symptoms considered for the cut-off point increases, the relative effects of income and wealth increase too.

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Table 6. Robustness check for the effects of household wealth and income on depression (all countries)

	IV probit	
	Panel A	Panel B
All ages:		
Log wealth$_{irt}$	−0.0696***	−0.1930***
Years of education$_{irt}$	−0.0116***	−0.0117***
Limitation with activities$_{irt}$	0.5809***	0.5944***
At least two chronic diseases$_{irt}$	0.3300***	0.3454***
Age$_{irt}$	−0.0863***	−0.0882***
Age$^2_{irt}$	0.0006***	0.0006***
Gender$_{irt}$	0.3973***	0.3817***
First-stage *F*-statistic	$F(1, 60{,}841) = 316.91$	$F(1, 60{,}841) = 297.81$
Wald test of exogeneity	$\chi^2(1) = 2.33$, $p = 0.1270$	$\chi^2(1) = 6.04$, $p = 0.014$
Observations (N)	60,864	60,864
Age 50–64:		
Log wealth$_{irt}$	−0.0228	−0.0615
Years of education$_{irt}$	−0.0175***	−0.0174***
Limitation with activities$_{irt}$	0.5605***	0.5629***
At least two chronic diseases$_{irt}$	0.3965***	0.4021***
Age$_{irt}$	0.0154	0.0018
Age$^2_{irt}$	−0.0002	−0.0001
Gender$_{irt}$	0.4008***	0.3935***
First-stage *F*-statistic	$F(1, 25{,}287) = 131.97$	$F(1, 25{,}287) = 124.32$
Wald test of exogeneity	$\chi^2(1) = 0.32$, $p = 0.572$	$\chi^2(1) = 0.10$, $p = 0.7548$
Observations (N)	25,310	25,310
Age 65+:		
Log wealth$_{irt}$	−0.1096***	−0.3036***
Years of education$_{irt}$	−0.0062***	−0.0069*
Limitation with activities$_{irt}$	0.5908***	0.6107***
At least two chronic diseases$_{irt}$	0.2875***	0.3044***
Age$_{irt}$	−0.0267	−0.0347
Age$^2_{irt}$	0.0002*	0.0002*
Gender$_{irt}$	0.3808***	0.3543***
First-stage *F*-statistic	$F(1, 35{,}531) = 182.27$	$F(1, 35{,}531) = 182.27$
Wald test of exogeneity	$\chi^2(1) = 5.63$, $p = 0.017$	$\chi^2(1) = 7.26$, $p = 0.071$
Observations (N)	35,554	35,554

Notes: The dependent variable is depression in binary format (Eurodcat). Standard errors are robust to arbitrary heteroscedasticity and corrected for clustering at the household level. The instrument which is used for the instrumental variable (IV) probit estimation is: interest/dividends from bank accounts, bonds, stocks and mutual funds. All predictors refer to the respondent.
Significance levels: * $p < 0.1$, *** $p < 0.01$.

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Table 7. Robustness checks with various EURO-D cut-off points (all countries and all ages)

	Panel A		Panel B	
Variables	Probit	IV probit	Probit	IV probit
EURO-D cut-off ⩾3:				
Log wealth$_{irt}$	−0.0347***	−0.1116***	−0.0375***	−0.2062***
Years of education$_{irt}$	−0.0132***	−0.0046***	−0.0156***	−0.0087***
Limitation with activities$_{irt}$	0.5730***	0.5411***	0.5830***	0.5709***
Number of chronic diseases$_{irt}$	0.3159***	0.3007***	0.3222***	0.3244***
Age$_{irt}$	−0.0984***	−0.0739***	−0.1054***	−0.0873***
Age$^2_{irt}$	0.0007***	0.0005***	0.0007***	0.0006***
Gender$_{irt}$	0.3965***	0.3825***	0.3963***	0.3727***
First-stage *F*-statistic	$F(1, 60,841) = 2,657.38$		$F(1, 60,841) = 2,804.60$	
Wald test of exogeneity	$\chi^2(1) = 78.74$, $p = 0.000$		$\chi^2(1) = 111.16$, $p = 0.000$	
Observations (N)	60,864		60,864	
EURO-D cut-off ⩾5:				
Log wealth$_{irt}$	−0.0381***	−0.1189***	−0.0492***	−0.2238***
Years of education$_{irt}$	−0.0196***	−0.0107***	−0.0223***	−0.0152***
Limitation with activities$_{irt}$	0.6049***	0.5713***	0.6163***	0.6036***
Number of chronic diseases$_{irt}$	0.3554***	0.3393***	0.3637***	0.3657***
Age$_{irt}$	−0.0942***	−0.0688***	−0.1015***	−0.0832***
Age$^2_{irt}$	0.0006***	0.0004***	0.0007***	0.0005***
Gender$_{irt}$	0.3975***	0.3823***	0.3964***	0.3714***
First-stage *F*-statistic	$F(1, 60,841) = 2,657.38$		$F(1, 60,841) = 2,804.60$	
Wald test of exogeneity	$\chi^2(1) = 60.37$, $p = 0.000$		$\chi^2(1) = 83.01$, $p = 0.000$	
Observations (N)	60,864		60,864	
EURO-D cut-off ⩾6:				
Log wealth$_{irt}$	−0.0395***	−0.1403***	−0.0513***	−0.2653***
Years of education$_{irt}$	−0.0229***	−0.0119***	−0.0259***	−0.0173***
Limitation with activities$_{irt}$	0.6235***	0.5822***	0.6360***	0.6210***
Number of chronic diseases$_{irt}$	0.3605***	0.3406***	0.3699***	0.3722***
Age$_{irt}$	−0.0941***	−0.0627***	−0.1017***	−0.0796***
Age$^2_{irt}$	0.0006***	0.0004***	0.0007***	0.0005***
Gender$_{irt}$	0.3879***	0.3691***	0.3866***	0.3562***
First-stage *F*-statistic	$F(1, 60,841) = 2,657.38$		$F(1, 60,841) = 2,804.60$	
Wald test of exogeneity	$\chi^2(1) = 70.65$, $p = 0.000$		$\chi^2(1) = 93.73$, $p = 0.000$	
Observations (N)	60,864		60,864	

Notes: The dependent variable is depression in binary format (Eurodcat). Standard errors are robust to arbitrary heteroscedasticity and corrected for clustering at the welfare-system level. The instrument which is used for the instrumental variable (IV) probit estimation is: years of partner's education. Model additionally controls for country of residence. All predictors refer to the respondent.
Significance level: *** $p < 0.01$.

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Table 8. Robustness checks across regions with EURO-D cut-off ⩾3

	Southern Europe		Western Europe		Central/Eastern Europe		Nordic	
Variables	Probit	IV probit	Probit	IV probit	Probit	IV probit	Probit	IV probit
All ages:								
Log wealth$_{irt}$	−0.0399***	−0.1883***	−0.0382***	−0.0835***	−0.0283***	−0.1248***	−0.0367***	−0.0716***
Years of education$_{irt}$	−0.0136***	−0.0006	−0.0066***	−0.0018	−0.0243***	−0.0073*	0.0003	0.0039
Limitation with activities$_{irt}$	0.6193***	0.5720***	0.5653***	0.5438***	0.5217***	0.4897***	0.5785***	0.5558***
At least two chronic diseases$_{irt}$	0.3647***	0.3517***	0.2911***	0.2723***	0.3162***	0.3086***	0.2794***	0.2705***
Age$_{irt}$	−0.1086***	−0.0606***	−0.0937***	−0.0780***	−0.0828***	−0.0502**	−0.1371***	−0.1302***
Age$^2_{irt}$	0.0008***	0.0004***	0.0006***	0.0005***	0.0006***	0.0003***	0.0009***	0.0009***
Gender$_{irt}$	0.4321***	0.4290***	0.4254***	0.4199***	0.3415***	0.3121***	0.3776***	0.3676***
First-stage *F*-statistic	$F(1, 16{,}511) = 400.56$		$F(1, 18{,}467) = 1{,}064.99$		$F(1, 1{,}8407) = 768.05$		$F(1, 7{,}435) = 426.42$	
Wald test of exogeneity	$\chi^2(1) = 44.21$, $p = 0.000$		$\chi^2(1) = 10.73$, $p = 0.011$		$\chi^2(1) = 36.91$, $p = 0.000$		$\chi^2(1) = 2.44$, $p = 0.118$	
Observations (N)	16,522		18,479		18,419		7,444	
All ages:								
Log income$_{irt}$	−0.0373***	−0.1555***	−0.0607***	−0.1792***	−0.0323***	−0.2027***	−0.0976***	−0.1628***
Years of education$_{irt}$	−0.0154***	−0.0048	−0.0084***	−0.0039	−0.0275***	−0.0179**	−0.0019	0.0001
Limitation with activities$_{irt}$	0.6291***	0.6036***	0.5740***	0.5599***	0.5278***	0.5184***	0.5909***	0.5834***
At least two chronic diseases$_{irt}$	0.3703***	0.3796***	0.3026***	0.2959***	0.3185***	0.3228***	0.2858***	0.2840***
Age$_{irt}$	−0.1136***	−0.0677***	−0.1041***	−0.0989***	−0.0880***	−0.0658***	−0.1472***	−0.1488***
Age$^2_{irt}$	0.0008***	0.0005***	0.0007***	0.0006***	0.0006***	0.0005***	0.0010***	0.0010***

(*Continued*)

Table 8. (*Continued.*)

	Southern Europe		Western Europe		Central/Eastern Europe		Nordic	
Variables	Probit	IV probit	Probit	IV probit	Probit	IV probit	Probit	IV probit
$Gender_{irt}$	0.4279***	0.4400***	0.4197***	0.4028***	0.3447***	0.3229***	0.3720***	0.3612***
First-stage *F*-statistic	$F(1, 16{,}511) = 236.19$		$F(1, 18{,}467) = 1{,}835.08$		$F(1, 18{,}407) = 1{,}438.07$		$F(1, 7{,}435) = 1{,}492.20$	
Wald test of exogeneity	$\chi^2(1) = 52.49$, $p = 0.000$		$\chi^2(1) = 17.10$, $p = 0.000$		$\chi^2(1) = 45.69$, $p = 0.000$		$\chi^2(1) = 2.03$, $p = 0.1539$	
Observations (N)	16,522		18,479		18,419		7,444	

Notes: The dependent variable is depression in binary format (Eurodcat). Standard errors are robust to arbitrary heteroscedasticity and corrected for clustering at the household level. The instrument which is used for the instrumental variable (IV) probit estimation is: years of partner's education. All predictors refer to the respondent.
Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Further robustness checks were also performed to assess the relative effects of (a) the substitution of no income and of negative wealth values with an income/wealth of €1 and (b) the assumption that years of partner's education are zero for unpartnered respondents. In the first case, additional models were run using income and wealth in continuous form (not shown here); the findings indicate that associations remain significant, pointing to the expected direction and the differentials observed in the main models, for instance the greater effect of wealth among younger respondents, persist. In the latter case, models were run excluding unpartnered persons (not shown here). The findings indicate that the estimates remain significant and of a similar magnitude to our main models while differentials, *i.e.* that income seems of a greater consequence compared to wealth, persist. Overall, we conclude that the findings of our main specification are consistent and robust to the above-mentioned assumptions.

Finally, the sensitivity of our findings to the choice of the imputed data-set was assessed, repeating the analysis for the total sample and for persons aged 50–64 and 65 or higher, using separately each of the remaining four imputed data-sets as well as the combined five imputed data-sets. The results (Table 9) indicate that the findings of the main models are robust since the coefficients for income and wealth in all cases are statistically significant and differentiate only slightly, whereas the differentials observed in our main models between the above-mentioned age groups persist. Further, the coefficients of the covariates (not shown here) maintain the expected associations while the *F*-statistic indicates in all instances that our instrument is relevant.

Discussion

Socio-economic inequalities in physical and mental health are a major area of research. There is a considerable amount of analyses indicating that SES, including concurrent income and wealth, has a strong impact on depression among older adults. Many studies exploring such issues, however, are hampered by reverse causality between health and SES as well as by omitted variable bias. To overcome these impediments, instrumental variable approaches have been used more recently, but findings are not consistent regarding the relative effects of these factors due to the choice of different instruments, while most of them apply only to the US population and to selected groups of persons (*i.e.* lottery winners, pensioners, homeowners, *etc.*) and cannot, thus, be generalised. Further, it is debatable whether income, which represents the means to provide instantly for necessities, is more important among older adults, especially pensioners, compared to wealth, which reflects a cumulative, long-term process and may provide a safety net in times of hardship. Hence, the present paper aims to assess the relative importance of wealth *versus* income in predicting depression among persons aged 50 or higher in Europe, using data from the most recent wave of SHARE (Wave 6) and employing an IV probit identification strategy, which accounts for possible endogeneity of the main variables of interest used in the study. The analysis distinguishes persons aged below 65, who include a high proportion of working population, from those aged 65 or higher, who are mostly retired, as retirement is often linked, on the one hand, to a reduction in income and greater dependence on accumulated

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

Table 9. Estimates of wealth and income by imputed data-set (1–5) based on instrumental variable (IV) probit models: coefficients (with significance levels) and first-stage *F*-statistic

	Log(wealth)		Log(income)	
Ages and imputation data-set	Coefficient	*F*-statistic	Coefficient	*F*-statistic
All ages (N = 60,864 observations):				
Imputation 1	−0.1087***	2,657.38	−0.2029***	2,804.60
Imputation 2	−0.1062***	2,467.08	−0.2034***	2,929.98
Imputation 3	−0.1074***	2,478.00	−0.2075***	2,875.50
Imputation 4	−0.1119***	2,393.18	−0.2119***	2,877.58
Imputation 5	−0.1129***	2,426.34	−0.2144***	2,908.85
All imputed data-sets combined	−0.1089***	12,258.73	−0.2008***	14,468.99
Age 50–64 (N = 25,310 observations):				
Imputation 1	−0.1218***	1,096.26	−0.2167***	1,074.37
Imputation 2	−0.1151***	1,015.68	−0.2122***	1,156.87
Imputation 3	−0.1131***	1,032.07	−0.2126***	1,115.99
Imputation 4	−0.1218***	972.33	−0.2202***	1,112.49
Imputation 5	−0.1191***	1,000.00	−0.2189***	1,117.59
All imputed data-sets combined	−0.1173***	5,049.02	−0.2165***	5,608.61
Age 65+ (N = 35,554 observations):				
Imputation 1	−0.0994***	1,575.30	−0.1917***	2,102.86
Imputation 2	−0.1008***	1,488.19	−0.1976***	2,100.00
Imputation 3	−0.1046***	1,478.59	−0.2047***	2,104.74
Imputation 4	−0.1054***	1,459.21	−0.2060***	2,116.23
Imputation 5	−0.1103***	1,459.36	−0.2135***	2,151.23
All imputed data-sets combined	−0.1038***	7,382.02	−0.2028***	10,607.26

Notes: Standard errors are robust to arbitrary heteroscedasticity and corrected for clustering at the household level. The instrument which is used for the IV probit estimation is: years of partner's education. All predictors refer to the respondent.
Significance level: *** $p < 0.01$.

resources and, on the other hand, with declining health (Coe and Zamarro, 2011; Belloni *et al.*, 2016; Clouston and Denier, 2017). Moreover, four European regions were considered separately, Southern, Central/Eastern, Northern and Western Europe, due to their differences in depression levels, socio-economic indicators, living conditions and welfare systems (Eikemo *et al.*, 2008; Van de Velde *et al.*, 2010; Huijts *et al.*, 2017).

The descriptive analysis indicates higher levels of depression in the more disadvantaged Central/Eastern and Southern regions of Europe compared to Western and particularly Northern areas. Hence, the findings support the notion of socio-

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

economic inequalities in mental health across Europe and are in accordance with past analyses based on European Social Survey data showing a similar divide (Van de Velde *et al*., 2010; Huijts *et al*., 2017), as well as with findings indicating that a country's economic resources may increase the average level of health of the population (Semyonov *et al*., 2013). Further, research considering the effects of the European financial crisis of 2008 suggests that austerity policies in Southern Europe resulted in a decline in the accessibility of health-care services and a consequent worsening in health (Karanikolos *et al*., 2013).

The present analysis also shows a significant inverse association of both wealth and income with depression across all Europe. This is roughly in accordance with the findings of Ettner (1996) who indicates a significant effect of income on mental health in the USA, of Golberstein (2015) who also finds an effect of income on the mental health of retired women in the USA and with the results of Schwandt (2018) who suggests that there is a significant positive effect of wealth on the mental health of retirees in the USA. However, it contrasts with other findings which show only minor or no effects of wealth on general health in the USA and Sweden (Kim and Ruhm, 2012; Erixson, 2017) or of income on mortality (Schnalzenberger, 2016).

Moreover, the present results reveal a difference in the role and the magnitude of the effect of income and wealth across different regions of Europe. First, though both measures exhibit a measurable effect, their impact is greater in the poorer Central/Eastern and Southern regions as opposed to the more affluent North/West; this divide is more pronounced for wealth. Second, income seems to have a stronger effect compared to wealth in all instances. Third, in Central/Eastern and Northern regions the relative effect of both income and wealth is more marked among younger respondents; in particular, in the latter case neither is a significant predictor among persons aged 65 or higher. By contrast, among Western Europeans both income and wealth have a greater effect among older respondents, whereas in Southern Europe wealth seems equally important for both age groups while income has a greater effect among persons aged 65 or higher.

The fact that socio-economic indicators have a greater impact on depression in poorer regions is probably partly attributable to differences in the accessibility and affordability of health-care services between different welfare regimes, but also to policies that act as a safety net for persons of scarce financial resources in Northern and Western European countries (Eurostat, 2014). Other research also shows that income-related health inequalities in self-rated health and long-standing illness differentiate across welfare regimes, and are very pronounced in Southern and Central/Eastern Europe as opposed to North/Western regions (Eikemo *et al*., 2008). Further, it has been suggested that a more equal distribution of resources, as is the case in Nordic countries, weakens the tie between wealth and physical health at the individual level (Semyonov *et al*., 2013). Indeed the lack of a significant effect of both income and wealth on depression in the present study noted in Northern Europe for persons aged 65 or higher may be partly attributable to an equitable welfare system which trivialises the importance of individual means among retirees. Further, this contrasts with the finding that both income and wealth for persons aged 65 or higher have the strongest impact in Southern Europe.

The greater impact of income on depression compared to wealth, which is independent of region of residence, contrasts with findings of other analyses indicating that the latter measure is more important, especially among older persons (Martikainen *et al.*, 2003; Hochman and Skopek, 2013; Semyonov *et al.*, 2013). This divergence may be attributable, at least partly, to past research examining associations with measures of physical health and/or not taking into account reverse causality. Hence, it seems that income, a measure that reflects liquidity, instantaneous access to resources, and the financial ability of the consumer to cover needs and purchase products and services when the need arises is more important than wealth which includes intangible assets that do not have a direct impact on the purchasing power of the household.

Finally, the analysis does not provide any support for the thesis that wealth is of greater importance among older rather than younger persons as this holds only in Western Europe where income also has a greater effect among those aged 65 or higher.

Limitations of the study

Though the study has several strengths, such as the methodology, which accounts for endogeneity and omitted variable bias, as well as data deriving from a robust data-set covering several European countries, there are some limitations that need to be taken into account when considering the findings. First, all measures are self-reported, including symptoms of depression, income, wealth, years of partner's education and interest/dividends from bank accounts, bonds, stocks and mutual funds. As such, they might be affected by recall errors or misreporting in some instances. Further, non-clinical measures of depression tend to overestimate prevalence and, consequently, may underestimate the true effect of income and wealth.

Second, both income and wealth are partly based on imputed data which may introduce a degree of approximation in the estimates. Third, though the analysis controls for a number of important predictors of depression, some factors may have been omitted, such as immigrant status, excessive alcohol consumption, *etc.* (Boden and Fergusson, 2011; Lanari and Bussini, 2012). Nevertheless, the method used in the analysis accounts for omitted variable bias. Fourth, regions include countries which exhibit similar characteristics in terms of living standards, socio-economic level and welfare systems but there are still differences which are concealed when they are considered as a group. However, the analysis controls for country of residence, thus limiting the relative effects. This is especially true for Central/Eastern Europe, where welfare systems have been formed quite recently, since the 1990s, and present variability. In future research, it may be of interest to observe differences across countries, though numbers may not allow distinguishing between younger and older respondents. Further, it would be worth considering the effects of income and wealth on other aspects of health, such as self-perceived health, cognitive function and activity restrictions.

It should be noted that in all papers employing an instrumental variable strategy, statistical proof of strength and validity does not necessarily imply that the selected instrument is the most appropriate. In fact, other instruments that are theoretically

https://doi.org/10.1017/S0144686X19000679 Published online by Cambridge University Press

and statistically equally appropriate may exist. Moreover, the instrument chosen in this instance, years of partner's education, might overestimate the effects of income and wealth on depression, due to assortative mating (Huang *et al.*, 2009). Nevertheless, use of a second instrument in the robustness check, separately and in conjunction with the main instrument, indicates that years of partner's education is a valid instrument and reinforces our main conclusions.

Conclusion

The main findings of the analysis are as follows: (a) there is substantial inequality in depression levels across European regions; (b) income and wealth inequalities in depression are more pronounced in the more disadvantaged regions of Europe in terms of standards of living and welfare regimes; and (c) income seems to have a greater effect on depression than wealth across Europe. The analysis does not provide evidence to support the hypothesis that wealth may be more important among persons age 65 or higher, who include a high proportion of retirees.

Hence, the present research seems to support the thesis that higher socioeconomic level of a country and more equitable welfare systems are linked to better mental health and less inequality. Nevertheless, SES at the individual level still plays a significant role in depression. As the analysis refers to the post-2008 European economic crisis period, which is ongoing in some countries (*e.g.* Greece), it would be of great interest in future research to examine whether associations differed pro crisis.

Data. This paper uses data from SHARE Wave 6 (doi:10.6103/SHARE.w6.600). For methodological details, *see* Börsch-Supan *et al.* (2013).

Author ORCIDs. Dimitrios Kourouklis, 0000-0002-8068-4363; Georgia Verropoulou, 0000-0001-6544-2086; Cleon Tsimbos 0000-0002-4563-0765

Financial support. This research received no specific grant from any funding agency, commercial or not-for-profit sectors.

Conflict of interest. The authors declare no conflicts of interest.

Ethical standards. Ethical approval was not required.

References

Apouey B and Clark AE (2015) Winning big but feeling no better? The effect of lottery prizes on physical and mental health. *Health Economics* **24**, 516–538.

Arsenijevic J, Pavlova M and Groot W (2013) Measuring the catastrophic and impoverishing effect of household health care spending in Serbia. *Social Science & Medicine* **78**, 17–25.

Atalay K, Edwards R and Liu BY (2017) Effects of house prices on health: new evidence from Australia. *Social Science & Medicine* **192**, 36–48.

Beekman AT, Copeland JR and Prince MJ (1999) Review of community prevalence of depression in later life. *British Journal of Psychiatry* **174**, 307–311.

Belloni M, Meschi E and Pasini G (2016) The effect on mental health of retiring during the economic crisis. *Health Economics* **25**, 126–140.

Berger N, Van Oyen H, Cambois E, Fouweather T, Jagger C, Nusselder W and Robine JM (2015) Assessing the validity of the Global Activity Limitation Indicator in fourteen European countries. *BMC Medical Research Methodology* **15**. doi:10.1186/1471-2288-15-1

Bergmann M, Kneip T, De Luca G and Scherpenzeel A (*2017*) Survey participation in the Survey of Health, Ageing and Retirement in Europe (SHARE), Wave 1–6. Based on Release 6.0.0 (March 2017). Munich Center for the Economics of Aging (MEA), SHARE Working Paper Series 31–2017.

Bernheim BD and Garrett DM (2003) The effects of financial education in the workplace: evidence from a survey of households. *Journal of Public Economics* **87**, 1487–1519.

Boden JM and Fergusson DM (2011) Alcohol and depression. *Addiction* **106**, 906–914.

Börsch-Supan A (2017) Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 6. Release version 6.0.0. SHARE-ERIC (Data-set). doi:10.6103/SHARE.w6.600.

Börsch-Supan A, Brandt M, Hunkler C, Kneip T, Korbmacher J, Malter F, Schaan B, Stuck S and Zuber S (2013) Data resource profile: the Survey of Health, Ageing and Retirement in Europe (SHARE). *International Journal of Epidemiology* **42**, 992–1001.

Buber I and Engelhardt H (2011) The association between age and depressive symptoms among older men and women in Europe. Findings from SHARE. *Comparative Population Studies* **36**, 1.

Butterworth P, Rodgers B and Windsor TD (2009) Financial hardship, socio-economic position and depression: results from the PATH Through Life Survey. *Social Science & Medicine* **69**, 229–237.

Castro-Costa E, Dewey M, Stewart R, Banerjee S, Hupper F, Mendonca-Lima C, Bula C, Reisches F, Wancata J, Ritchie K and Tsolaki M (2007) Prevalence of depressive symptoms and syndromes in later life in ten European countries: the SHARE study. *British Journal of Psychiatry* **191**, 393–401.

Castro-Costa E, Dewey M, Stewart R, Banerjee S, Huppert F, Mendonca-Lima C, Bula C, Reisches F, Wancata J, Ritchie K and Tsolaki M (2008) Ascertaining late-life depressive symptoms in Europe: an evaluation of the survey version of the EURO-D scale in 10 nations. The SHARE project. *International Journal of Methods in Psychiatric Research* **17**, 12–29.

Christelis D, Jappeli T and Padula M (2005) Wealth and portfolio composition. In Börsch-Supan A, Brugiavini A, Jürges H, Mackenbach J, Siegrist J and Weber G (eds), *Health, Ageing and Retirement in Europe – First Results from the Survey of Health, Ageing and Retirement in Europe*. Mannheim, Germany: Mannheim Research Institute for the Economics of Aging (MEA), pp. 310–317.

Clouston SAP and Denier N (2017) Mental retirement and health selection: analyses from the U.S. Health and Retirement Study. *Social Science and Medicine* **178**, 78–86.

Coe NB and Zamarro G (2011) Retirement effects on health in Europe. *Journal of Health Economics* **30**, 77–86.

Colman I and Ataullahjan A (2010) Life course perspectives on the epidemiology of depression. *Canadian Journal of Psychiatry* **55**, 622–632.

Courtin E and Avendano M (2016) Under one roof: the effect of co-residing with adult children on depression in later life. *Social Science & Medicine* **168**, 140–149.

Courtin E, Knapp M, Grundy E and Avendano-Pabon M (2015) Are different measures of depressive symptoms in old age comparable? An analysis of the CES-D and Euro-D scales in 13 countries. *International Journal of Methods in Psychiatric Research* **24**, 287–304.

D'Alisa S, Miscio G, Baudo S, Simone A, Tesio L and Mauro A (2006) Depression is the main determinant of quality of life in multiple sclerosis: a classification-regression (CART) study. *Disability and Rehabilitation* **28**, 307–314.

De Luca G and Peracchi F (2005) Survey participation in the first wave of SHARE. In Börsch-Supan A and Jürges H (eds), *The Survey of Health, Ageing and Retirement in Europe – Methodology*. Mannheim, Germany: Mannheim Research Institute for the Economics of Aging (MEA), pp. 88–101.

Dewa CS and Lin E (2000) Chronic physical illness, psychiatric disorder and disability in the workplace. *Social Science & Medicine* **51**, 41–50.

Dewey ME and Prince MJ (2005) Mental health. In Borsch-Supan A, Brugiavini A, Jürges H, Mackenbach J, Siegrist J and Weber G (eds), *Health, Ageing and Retirement in Europe – First Results from the Survey of Health, Ageing and Retirement in Europe*. Mannheim, Germany: Mannheim Research Institute for the Economics of Aging (MEA), pp. 118–125.

Eikemo TA, Bambra C, Joyce K and Dahl E (2008) Welfare state regimes and income-related health inequalities: a comparison of 23 European countries. *European Journal of Public Health* **18**, 593–599.

Erixson O (2017) Health responses to a wealth shock: evidence from a Swedish tax reform. *Journal of Population Economics* **30**, 1281–1336.

Ettner SL (1996) New evidence on the relationship between income and health. *Journal of Health Economics* **15**, 67–85.

Eurostat (2014) *Living Conditions in Europe. Population and Social Conditions Collection* (Statistical books). Brussels: Publication Office of the European Union. Available at http://ec.europa.eu/eurostat/documents/3217494/6303711/KS-DZ-14-001-EN-N.pdf/d867b24b-da98-427d-bca2-d8bc212ff7a8.

Eurostat (2018) *Eurostat Data on GDP per Capita, 2015*. Available at http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tec00001.

Fenger HM (2007) Welfare regimes in Central and Eastern Europe: incorporating post-communist countries in a welfare regime typology. *Contemporary Issues and Ideas in Social Sciences* **3**.

Ferrari AJ, Charlson FJ, Norman RE, Patten SB, Freedman G, Murray CJ, Vos T and Whiteford HA (2013) Burden of depressive disorders by country, sex, age, and year: findings from the global burden of disease study 2010. *PLOS Medicine* **10**. https://doi.org/10.1371/journal.pmed.1001547.

Ferraro KF and Shippee TP (2009) Aging and cumulative inequality: how does inequality get under the skin? *The Gerontologist* **49**, 333–343.

Ferrera M and Rhodes M (2013) *Recasting European Welfare States*. London: Routledge.

Fiske A, Wetherell JL and Gatz M (2009) Depression in older adults. *Annual Review of Clinical Psychology* **5**, 363–389.

Friedrich MJ (2017) Depression is the leading cause of disability around the world. *JAMA: The Journal of the American Medical Association* **317**, 1517–1517.

Fullerton CA, Busch AB, Normand SLT, McGuire TG and Epstein AM (2011) Ten-year trends in quality of care and spending for depression: 1996 through 2005. *Archives of General Psychiatry* **68**, 1218–1226.

Gadit AA (2004) Out-of-pocket expenditure for depression among patients attending private community psychiatric clinics in Pakistan. *Journal of Mental Health Policy and Economics* **7**, 23–28.

Gardner J and Oswald AJ (2007) Money and mental wellbeing: a longitudinal study of medium-sized lottery wins. *Journal of Health Economics* **26**, 49–60.

Golberstein E (2015) The effects of income on mental health: evidence from the social security notch. *Journal of Mental Health Policy and Economics* **18**, 27.

Hansen C, Hausman J and Newey W (2008) Estimation with many instrumental variables. *Journal of Business & Economic Statistics* **26**, 398–422.

Harman JS, Kelleher KJ, Reynolds CF and Pincus HA (2004) Out-of-pocket healthcare expenditures of older Americans with depression. *Journal of the American Geriatrics Society* **52**, 809–8–3.

Heller-Sahlgren G (2017) Retirement blues. *Journal of Health Economics* **54**, 66–78.

Hochman O and Skopek N (2013) The impact of wealth on subjective well-being: a comparison of three welfare-state regimes. *Research in Social Stratification and Mobility* **34**, 127–141.

Huang C, Li H, Liu PW and Zhang J (2009) Why does spousal education matter for earnings? Assortative mating and cross-productivity. *Journal of Labor Economics* **27**, 633–652.

Hudson CG (2005) Socioeconomic status and mental illness: tests of the social causation and selection hypotheses. *American Journal of Orthopsychiatry* **75**, 3–18.

Huijts T, Stornes P, Eikemo TA, Bambra C and HiNews Consortium (2017) Prevalence of physical and mental non-communicable diseases in Europe: findings from the European Social Survey (2014) special module on the social determinants of health. *European Journal of Public Health* **27**, 8–13.

Karanikolos M, Mladovsky P, Cylus J, Thomson S, Basu S, Stuckler D, Mackenbach JP and McKee M (2013) Financial crisis, austerity, and health in Europe. *The Lancet* **381**, 1323–1331.

Kemppainen T (2012) *Well-being in Socio-political Context. European Welfare Regimes in Comparison. Studies in Social Security and Health*. Helsinki: Kela, Research Department.

Kim B and Ruhm CJ (2012) Inheritances, health and death. *Health Economics* **21**, 127–144.

Kim Y and Yang B (2011) Relationship between catastrophic health expenditures and household incomes and expenditure patterns in South Korea. *Health Policy* **100**, 239–246.

Lanari D and Bussini O (2012) International migration and health inequalities in later life. *Ageing & Society* **32**, 935–962.

Lerner D and Henke RM (2008) What does research tell us about depression, job performance, and work productivity? *Journal of Occupational and Environmental Medicine* **50**, 401–410.

Lindahl M (2005) Estimating the effect of income on health and mortality using lottery prizes as an exogenous source of variation in income. *Journal of Human Resources* **40**, 144–168.

Lorant V, Croux C, Weich S, Deliège D, Mackenbach J and Ansseau M (2007) Depression and socio-economic risk factors: 7-year longitudinal population study. *British Journal of Psychiatry* **190**, 293–298.

Lorant V, Deliège D, Eaton W, Robert A, Philippot P and Ansseau M (2003) Socioeconomic inequalities in depression: a meta-analysis. *American Journal of Epidemiology* **157**, 98–112.

Martikainen P, Adda J, Ferrie JE, Smith GD and Marmot M (2003) Effects of income and wealth on GHQ depression and poor self-rated health in white collar women and men in the Whitehall II study. *Journal of Epidemiology & Community Health* **57**, 718–723.

McInerney M, Mellor JM and Nicholas LH (2013) Recession depression: mental health effects of the 2008 stock market crash. *Journal of Health Economics* **32**, 1090–1104.

Mulatu MS and Schooler C (2002) Causal connections between socio-economic status and health: reciprocal effects and mediating mechanisms. *Journal of Health and Social Behavior* **43**, 22.

Muntaner C, Eaton WW, Miech R, and O'campo P (2004) Socioeconomic position and major mental disorders. *Epidemiologic Reviews* **26**, 53–62.

Pan X and Sambamoorthi U (2015) Health care expenditures associated with depression in adults with cancer. *Journal of Community and Supportive Oncology* **13**, 240.

Popova Y and Kozhevnikova M (2013) Interdependence of HDI and budget redistribution within the Scandinavian and European social models. *Economics and Management* **18**, 562–575.

Prince MJ, Beekam ATF, Deeg DJH, Fuhrer R, Jonker C, Kivela SL, Lawlor BA, Lobo A, Magnusson H, Meller I, Van Oyen H, Reischies F, Roelands M, Skoog I, Turrina C and Copeland JRM (1999) Depression symptoms in late life assessed using the EURO-D scale. *British Journal of Psychiatry* **174**, 339–345.

SHARE (2018) Release Guide 6.1.0. Available online at http://www.shareproject.org/fileadmin/pdf_documentation/SHARE_release_guide_6-1-0.pdf. [Accessed 15 February 2019].

Schnalzenberger M (2016) Causal effect of income on health: investigating two closely related policy reforms in Austria. *Journal of the Economics of Ageing* **7**, 6–16.

Schultz R, Beach SR, Ives DG, Martire LM, Ariyo AA and Kop WJ (2000) Association between depression and mortality in older adults: the Cardiovascular Health Study. *Archives of Internal Medicine* **160**, 1761–1768.

Schwandt H (2018) Wealth shocks and health outcomes: evidence from stock market fluctuations. Centre for Economic Policy Research (CEPR), Discussion Paper DP12562. Available at https://ssrn.com/abstract=3098158.

Semyonov M, Lewin-Epstein N and Maskileyson D (2013) Where wealth matters more for health: the wealth–health gradient in 16 countries. *Social Science & Medicine* **81**, 10–17.

Shavers VL (2007) Measurement of socioeconomic status in health disparities research. *Journal of the National Medical Association* **99**, 1013–1022.

Staiger D and Stock JH (1997) Instrumental variables regression with weak instruments. *Econometrica* **65**, 557–586.

Stock JH, Wright JH and Yogo M (2002) A survey of weak instruments and weak identification in generalized method of moments. *Journal of Business & Economic Statistics* **20**, 518–529.

Thoits PA (2010) Stress and health: major findings and policy implications. *Journal of Health and Social Behavior* **51**, S41–S53.

Turvey CL, Schultz SK, Beglinger L and Klein DM (2009) A longitudinal community-based study of chronic illness, cognitive and physical function, and depression. *American Journal of Geriatric Psychiatry* **17**, 632–641.

Ubel PA, Abernethy AP and Zafar SY (2013) Full disclosure – out-of-pocket costs as side effects. *New England Journal of Medicine* **369**, 1484–1486.

Van de Velde S, Bracke P, Levecque K and Meuleman B (2010) Gender differences in depression in 25 European countries after eliminating measurement bias in the CES-D 8. *Social Science Research* **39**, 396–404.

Van Rooij M, Lusardi A and Alessie R (2011) Financial literacy and stock market participation. *Journal of Financial Economics* **101**, 449–472.

Van Rooij MC, Lusardi A and Alessie RJ (2012) Financial literacy, retirement planning and household wealth. *The Economic Journal* **122**, 449–478.

World Health Organization (WHO) (2017*a*) *Depression and Other Common Mental Disorders Global Health Estimates* (WHO/MSD/MER/2017.2). Available at http://www.who.int/mental_health/management/depression/prevalence_global_health_estimates/en/.

World Health Organization (WHO) (2017*b*) *World Population Ageing 2017 – Highlights*. New York, NY: United Nations. Available at http://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2017_Highlights.pdf.

Woo JM, Kim W, Hwang TY, Frick KD, Choi BH, Seo YJ, Kang EH, Kim SJ, Ham BJ, Lee JS and Park YL (2011) Impact of depression on work productivity and its improvement after outpatient treatment with antidepressants. *Value in Health* **14**, 475–482.

Cite this article: Kourouklis D, Verropoulou G, Tsimbos C (2020). The impact of wealth and income on the depression of older adults across European welfare regimes. *Ageing & Society* **40**, 2448–2479. https://doi.org/10.1017/S0144686X19000679