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ORIGINAL ARTICLE

The impact of savings and credit on health and health behaviours: an outcome-wide longitudinal approach

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Abstract

Objectives This study evaluated decisions related to debt and savings on physical health, emotional health and health behaviours.

Methods The longitudinal data from the Polish biennial household panel—Social Diagnosis Survey—were used. Evidence for a link between credit/savings and health/health behaviours was presented using three waves of the data and an outcome-wide regression analysis. To circumvent endogeneity, variables temporally prior to exposure were used as controls. Sensitivity analysis for unmeasured confounding, conducted using *E*-values, provided a check for robustness.

Results Debt proved a significant stressor, affecting three of five physical health measures. Over-indebted individuals suffered even more in terms of physical health outcomes. The role of savings in physical health was much less significant, yet had significant bearing on measures of emotional health. In terms of emotional health, debt (over-indebtedness in particular) influenced loneliness and increased suicidal thoughts. With respect to health behaviours, savings appeared significant in reducing smoking and increasing uptake of sport activities, while debt had no significant effect in these areas.

Conclusions Recommendations are formulated to foster saving activity and develop institutional solutions for over-indebtedness.

Keywords Credit · Savings · Health behaviour · Health · Longitudinal study · Outcome-wide regression

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Introduction

Bertola and Hochguertel (2007, p. 120) claimed that in ideal circumstances, "there would not even be a need to distinguish (…) savings from borrowing, as each of them could be costlessly and instantly converted from one form to another and from there to consumption". This reasoning is common in economics and stems from state-of-the-art modelling principles for consumer behaviour but includes a hidden assumption that financial decisions are irrelevant to utility and, consequently, have no bearing on well-being. In reality, saving and borrowing decisions affect and are affected by individual health and well-being. Decisions about credit and savings follow consumption choices. These choices are frequently emotional but, despite being made in a particular moment in time, have long-lasting consequences for health and well-being (Loewenstein 2000).

Despite claims that debt that can be repaid or managed is not problematic (Fitch et al. 2007), all types of debt (not only problem debt) can be detrimental to health. In

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particular, various studies confirmed the impact of debt on depression and suicidal thoughts (Fitch et al. 2007; Richardson et al. 2013; Turunen and Hiilamo 2014). Individuals with higher value non-mortgage debts are less likely to report complete psychological well-being (Brown et al. 2005; Tay et al. 2017). Debtors are also more prone to various coping behaviours, including alcohol, tobacco and drug dependence (Richardson et al. 2013; Turunen and Hiilamo 2014; Angel 2016).

Here, we argue that not all debts should be considered equal. Problem debt, often classified under the term "over-indebtedness", draws special attention from the scientific community. Its measurement is complex and, to this purpose, a variety of approaches have been proposed (European Commision 2008; D'Alessio and Iezzi 2013). Indicators for over-indebtedness range from subjective opinions about the financial strain associated with debt, through debt-to-income ratios, to reported arrears and even court arranged solutions for resolution, such as, personal bankruptcy. Regardless of approach, preliminary studies show that over-indebtedness increases likelihood of ill health independently of other dimensions of socio-economic status (Angel 2016). It is detrimental to economic well-being (D'Alessio and Iezzi 2013) contributing in particular to psychological stress (Gathergood 2012),which leads to mental disorders (Emami 2010), poverty and consequent social exclusion (D'Alessio and Iezzi 2013), and its association with overweight and obesity is additional cause for concern (Münster et al. 2009; Emami 2010). Additionally, self-reported health deteriorates for people with difficulties covering their bills (Turunen and Hiilamo 2014; Kyriopoulos et al. 2016) and those with high debt relative to available assets (Sweet et al. 2013; Blázquez and Budría 2015). Nevertheless, the effect of debt burdens measured by debt-to-income or debt-to-assets ratios can be misleading since mortgage debt is found not to negatively affect health in some studies (Blázquez and Budría 2015). Georgarakos et al. (2010) showed that similar burdens generate much less distress in countries with a large share of mortgage debt.

Regarding savings, the literature indicates that available resources are strong predictors of life satisfaction (Berlin and Kaunitz 2015), facilitate progress towards stated goals and thus lead to positive affect (Diener and Fujita 1995). In particular, Shim et al. (2012) showed that the act of saving, representing future oriented behaviour, generates present and future value for individuals. They confirmed that financial attitude to savings leads to behavioural intention and then actual behaviour, which translates into improved emotional health. Savings are often associated with individual time preferences (Komlos et al. 2004), providing an indicator for value assigned to future emotional health outcomes. Higher savings correspond to activities that lead

to favourable outcomes (e.g. positive health behaviours such as healthier eating, sporting activity or not smoking). For example, Lawless et al. (2013) noted that time preferences measured with monetary indicators can predict smoking cessation and serve as an indicator for obesity. They show that consumers who were more patient were more likely to be more physically active.

Findings from the literature are often based on the cross-sectional data, rendering causal interpretation and deeper understanding of the relationship between financial behaviour and health more difficult. In particular, findings based on cross-sectional data may be biased by omission of unobserved individual level factors or—more importantly—due to reverse causality. Although it might be the case that savings and availability of money from credit might protect against ill health or deficiency in emotional health, it is also often the case that those who succumb to illness are more likely to stop saving or repaying of debts. Both these issues introduce endogeneity, rendering results inconclusive.

More evidence, therefore, is required to evaluate causal impact from financial behaviour on specific health outcomes and health behaviours. This paper not only offers to fill this gap, casting light on the health outcomes and health behaviours most likely to be influenced by household financial behaviours but also responds to the call of Tay et al. (2017) to provide more evidence on influence of types of debts and specific loan repayment obligations on health.

The study offers three novelties. First, it is the first to adopt an outcome-wide approach (VanderWeele 2017) to the investigation of debt and savings on physical and emotional health and health behaviours. Specific exposures are examined by this approach, but concomitant effects on multiple outcomes are considered simultaneously. This has the advantage, by looking at multiple outcomes within a common sample, of being able to compare effect sizes across outcomes. Here, with control for confounding data, the influence of both indebtedness and savings on multiple health and health behaviour outcomes were assessed simultaneously. Second, findings drawn from longitudinal data—by virtue of depiction of the logical temporal sequence of cause and effect—permit more evidence for causal interpretation of results. For each outcome (e.g. self-reported health), control is made for prior level of that variable so as to control for, and help rule out, reverse causation, i.e. the possibility that prior level of the outcome (e.g. life satisfaction) affects the baseline levels of credit and debt. Third, by applying a sensitivity measure—E-value (VanderWeele and Ding 2017)—it was possible to evaluate how robust conclusions were to potential remaining unmeasured confounding or endogeneity.

Section 2 details data sources, sample characteristics, measures and methods used for analysis. Section 3 presents

the results together with a robustness check for unmeasured confounding obtained from the *E*-values. Finally, Sect. 4 discusses the results together with conclusions.

Methods

Data source

The analysis builds on three waves of the biennial Polish household panel study (2011, 2013 and 2015)—Social Diagnosis (Czapiński and Panek 2015). Social Diagnosis is a panel survey aimed at investigating living conditions and well-being of Polish households. Data are representative for the Polish population aged over 15, covering the household financial situation (debt and savings), well-being and socio-economic characteristics and are collected by self-reported questionnaires. Relevant data and survey documentation are freely available (in Polish and English) in the public domain (http://www.diagnoza.com/index-en.html).

The economic environment in Poland during the period 2011–2015 was stable. Despite strong international turbulence associated with the Great Recession, Poland did not suffer economically from the crisis. There was not a single year with negative economic growth. Interest rates, critical to credit and savings remained stable in 2008–2013 and then gradually declined, following the international trend. Household behaviour with respect to debt and savings, despite changing trends, did not suffer from any shocks during the analysis period. Indebtedness of Polish households is still below the European Union average. Household savings are also lower than in other European countries (2016).

Sample

The 2011 study covered 36,655 individuals aged 16 and over. Of these, 25,717 individuals were surveyed in 2013. By 2015, the number of individuals covered by all three rounds of the survey had reduced to 19,492 respondents from 6809 households.

For analysis, all individuals with missing values for outcomes (i.e. well-being and health behaviours), control or exposure variables, i.e. debt and savings, were excluded. Individuals with non-missing control, exposure and outcome variables numbered 8227 to 8775 depending on the set of controls in particular model specification and missing data pattern for a specific outcome. Different sets of controls were applicable to all equations, since the relevant set of controls comprised the remaining outcomes from the baseline period (bar the specific outcome of interest in the particular model specification).

Measures

Exposure: savings

Respondents were subjected to evaluation whether they had savings or not (assessed simply as a yes/no item). Consequently, exposure was a binary outcome for the measurement of savings.

Exposure: credit

With respect to credit, distinction was made, not only between individuals with or without borrowing, but also for those classed as over-indebted. In this way, an ordered indicator with three distinct categories for debt—no credit; credit but not classified as over-indebtedness; and credit and classified as over-indebtedness—was available for analysis.

Our measure of over-indebtedness not only includes the value of debts with respect to household incomes but also seeks to reveal problematic debt by investigating debt objectives and sources. Multitude of debt objectives, acquiring credit from informal lenders additionally associated with relatively high value of debt and being in a spiral of debt (i.e. acquiring debt to repay previous debts) were expected to imply a problematic debt and were used to identify over-indebted individuals. As being over-indebted is not a straightforwardly defined stage determined by multiple criteria, the latent class analysis was applied to its identification. This methodology has already been used and successfully proven to provide clear indication of a class of over-indebted substantially different from other credit market participants (Białowolski 2014).

Outcomes

From the available data, 14 health outcomes classified as either physical or emotional health outcomes were available for consideration. Three health behaviour outcomes complemented the analysis. These were cigarette smoking, excessive alcohol consumption and sport. Outcomes assessed are given in Table 1.

Control variables

A rich set of control variables, already established as influential on health and health behaviours, was used to investigate the effect of various behaviours in the financial domain. These were measured and controlled for prior to exposure (i.e. in 2011), to ensure that they were confounders and not mediators (VanderWeele et al. 2017; Węziak-Białowolska and Białowolski 2016). Specifically,

Table 1 Well-being and health behaviours outcomes—Social Diagnosis (2011, 2013 and 2015), Poland

Outcome	Response scale
Physical health	
(1) Self-reported health: How satisfied are you with your health?	6 = extremely satisfied, …, 1 = extremely dissatisfied (continuous variable)
(2) Psychosomatic symptoms in the month preceding the survey measured using the Patient Health Questionnaire (PHQ-15, see: Online Resource)	0–30 (continuous variable)
(3) Not being worried about health conditions	0 = no; 1 = yes
(4) Sleeping well	0 = no; 1 = yes
(5) Not feeling tired	0 = no; 1 = yes
Emotional health	
(6) Happiness: how would you assess your current life?	4 = very happy, 3 = rather happy, 2 = rather unhappy, 1 = unhappy (continuous variable)
(7) Life satisfaction: to what extent are you satisfied with your life achievements?	6 = extremely satisfied, …, 1 = extremely dissatisfied (continuous variable)
(8) Life perception: how do you perceive your entire life? Could you say it was	7 = delightful, ..., 1 = terrible (continuous variable)
(9) Assessment of the last year: Considering all, do you think the last year was a good one for you?	0 = no; 1 = yes
(10) Being full of energy	0 = no; 1 = yes
(11) Having visited a psychologist or a psychiatrist in the last year	0 = no; 1 = yes
(12) Having thoughts about suicide in the recent months due to feeling depressed	0 = no; 1 = yes
(13) Willingness to live: at present, how strong is your willingness to live?	1 = I do not want to live at all; 10 = I want to live very much (continuous variable)
(14) Loneliness measured using a single question: do you feel lonely?	0 = no; 1 = yes
Health behaviours	
(15) Smoking tobacco products everyday	0 = no; 1 = yes
(16) Drinking too much alcohol in the last year	0 = no; 1 = yes
(17) Practicing sport	0 = no; 1 = yes

the analysis accounted for demographic variables (gender, age, marital status and education), objective financial conditions (equivalized household disposable income after log transformation) and labour market status (being unemployed versus other), subjective financial conditions, namely: (1) financial problems have worried you and made your life harder and (2) satisfaction with the financial situation. Social capital and civic engagement were also accommodated by controlling for generalized trust, satisfaction with relationship with friends and voting in the last parliamentary elections. Additionally, controls related to lifestyle were also included: time spent watching television, social and cultural activity (cinema, theatre, concert, restaurant, café or pub, meeting with friends) and general satisfaction with the way free time was spent. Differences in baseline health conditions were also captured by analysis and control variables including: having a certificate of disability, being seriously ill in the last year and experiencing activity limitations owing to health problems. Finally, in each regression, all remaining outcomes observed for 2011 were controlled for, as their influence on both perception of well-being and different household decisions in terms of finance was assumed. Baseline

savings and credit (in 2011) were also used in the analysis as controls, since these initial levels could potentially confound the relationship between savings and credit in 2013 and later health/health behaviour in 2015.

This approach is robust to the problems of simultaneous change in exposure and outcome, which are likely with the fixed effects approach. The adopted strategy controls for such phenomena by applying different time spans for outcome and exposure. The list of control variables with baseline descriptive statistics is given in Table 2.

Statistical analysis

The longitudinal dataset was used to investigate how financial behaviour (related to savings and credit) influences health and health behaviour outcomes. An outcome-wide approach was applied, in which multiple outcomes were considered simultaneously for a single exposure (VanderWeele 2017). Because of the longitudinal panel data employed, in contrast to many cross-sectional analyses, this approach could offer more plausible evidence for causality. Logical temporal sequence of cause and effect is evident from data.

Table 2 Baseline participant characteristics in the social diagnosis study (Poland)—by 2011 savings and debt (numbers represent percentages unless otherwise indicated)

	Total (n = 8775)	No credit (n = 5113)	Credit but not over-indebted (n = 3461)	Credit and over-indebted (n = 201)	No savings (N = 5547)	Savings (N = 3228)
Demographic characteristic						
Gender (male)	42.6	42.7	42.5	40.3	41.7*	44.1
Age—mean (SD)	49.3 (16.7)	51.7** (17.1)	45.9 (15.4)	46.2 (14.6)	48.9** (16.6)	49.9 (16.7)
16–24	8.8	8.5	9.2	10.0	9.6**	7.5
25–34	13.3	10.6**	17.5	11.9*	13.1	13.7
35–44	16.5	13.7**	20.4	21.4	16.3	17.0
45–54	20.5	20.0	20.9	26.4	21.2*	19.2
55–64	22.3	23.6**	20.4	21.9	21.8	23.1
65+	18.5	23.7**	11.5	8.5	18.0	19.5
Marital status						
Unmarried	19.0	19.2	18.7	16.4	20.5**	16.2
Married	66.1	64.0**	69.4	64.2	62.3**	72.6
Widowed	10.3	12.2**	7.5	9.5	12.0**	7.3
Divorced	3.9	3.9	3.7	9.5**	4.3*	3.3
Legally separated	0.2	0.1	0.3	0.0	0.2	0.2
Practically separated	0.6	0.6	0.4	0.5	0.7*	0.3
Education						
Primary or lower secondary	22.8	24.7**	19.9	21.9	27.6**	14.5
Upper secondary or vocational education	58.9	58.4	59.2	63.7	60.7**	55.7
Post-secondary or higher education	18.4	16.9**	20.9	14.4**	11.7**	29.8
Financial conditions						
Equivalized household disposable income in PLN– mean (SD)	1482.6 (1146.1)	1446.8** (1146.2)	1550.6 (1167.1)	1220.8** (548.4)	1252.7** (906.1)	1877.6 (1383.4)
Employment status (unemployed)	4.9	4.8	4.9	6.4	5.8**	3.2
Financial problems have worried you and made your life harder (often, rarely, never)						
Often	19.2	16.8**	21.1	46.3**	25.1**	8.9
Rarely—once or twice	54.7	53.3**	57.5	45.3**	56.7**	51.3
Never	26.1	30.0**	21.5	8.5**	18.2**	39.8
Satisfaction with financial situation (scale 1-6)—mean (SD)	2.61 (1.32)	2.69** (1.32)	2.54 (1.3)	1.67** (1.32)	2.28** (1.33)	3.18 (1.09)
Civic engagement						
Voting in the last parliamentary elections (yes)	73.8	75.2*	72.8	59.2**	70.7**	79.3
Lifestyle						
Attending religious services						
Never	25.0	21.7**	28.5	47.5**	25.4	24.4
Sometimes	25.0	24.6	25.6	23.5	25.8*	23.6
Weekly	37.3	39.5**	35.0	22.5**	36.4*	38.9
Very often	12.7	14.2**	10.9	6.5	12.4	13.2
Watching TV daily						
I do not watch TV	2.0	1.9	2.1	2.5	1.9	2.1
Less than an hour	8.6	8.2	9.3	6.0	8.8	8.2
1–2 h	30.1	29.8	30.7	27.4	29.4	31.2
2–3 h	27.8	28.6	26.7	27.9	27.2	28.9

Table 2 (continued)

	Total (n = 8775)	No credit (n = 5113)	Credit but not over-indebted (n = 3461)	Credit and over-indebted (n = 201)	No savings (N = 5547)	Savings (N = 3228)
3–4 h	15.9	16.3	15.7	10.5*	16.0	15.7
More than 4	15.7	15.3	15.6	25.9**	16.7	13.9**
Social and cultural activity—mean (SD)	2.57 (4.35)	2.38** (4.18)	2.87 (4.57)	2.55 (4.55)	2.21** (4.00)	3.21 (4.84)
Satisfaction with the manner of spending free time (scale 1–6)—mean (SD)	4.17 (1.09)	4.21 (1.06)	4.16 (1.07)	3.74** (1.11)	4.11** (1.09)	4.3 (1.01)
Health						
Having certificate of disability (yes)	13.6	14.6**	12.0	17.4*	14.7**	11.7
Being seriously ill in the last year (yes)	13.2	13	13.3	16.4	14.3**	11.2
Activity limitations owing to health problems						
Often	17.3	17.6	16.6	21.9	18.8**	14.7
Rarely (once or twice)	48.0	48.9*	46.5	49.8	48.3	47.4
Never	34.7	33.5**	36.9	28.4*	32.9**	38.0

Two sample tests were conducted to examine: (1) differences between those having savings and not (significance reported in the column "no savings"); (2) between those having credit and not (significance reported in the column "no credit"); (3) between those having credit but not over-indebted versus those over-indebted (significance reported in the column "credit and over-indebted"); SD—standard deviation

$*p < 0.05$; $**p < 0.01$

This approach allowed control for confounding effects of the exposure variables on outcomes, as exposure variables were measured temporarily prior to outcomes. Relevant to this study, strengths of exposures related to credit and saving decisions on health and health behaviour outcomes were assessed simultaneously to present associations across the whole spectrum of health outcomes and to avoid cherry picking of significant results only.

The relationship between financial decisions related to credit and savings in 2013 and health/health behaviour in 2015 was modelled using either the linear regression model for continuous outcomes or the logistic regression model for dichotomous outcomes:

$$\text{Linear regression: } H_{i,j,2015} = \beta_0 + \gamma_1 \text{CRED}_{i,2013} + \gamma_2 \text{SAV}_{i,2013} + \beta_1 X_{i,2011} + \eta_i,$$
$$i = 1,\ldots,N,$$

$$\text{Logistic regression: } \text{prob}(H_{i,j,2015} = 1)$$
$$= \frac{1}{1 + e^{-(\beta_0 + \gamma_1 \text{CRED}_{i,2013} + \gamma_2 \text{SAV}_{i,2013} + \beta_1 X_{i,2011} + \eta_i)}},$$
$$i = 1,\ldots,N$$

Here, subscript i represents an individual, subscript j represents one out of 17 outcomes, the variable $\text{CRED}_{i,2013}$ indicates exposure owing to credit and $\text{SAV}_{i,2013}$—existence of savings. $X_{i,2011}$ is a vector of pre-exposure control variables, and $H_{i,j,2015}$ is one of either 14 health or three health behaviour outcomes—17 independent models were estimated. β_0 represents a constant, β_1

shows the individual level characteristics (control variables) on a health or health behaviour outcome and γ_1 and γ_2 show the effects of credit and saving decisions on a health or health behaviour outcome. η_i is a disturbance term, assumed clustered at household level to avoid underreporting of standard errors of estimates.

Continuous outcomes were not standardized in order to present reaction of outcomes to impulses of exposure, scaled according to the original. Odds ratios for dichotomous outcomes were also reported. Bonferroni correction was applied to accommodate multiple testing (Dunnett 1955).

Sensitivity analysis assessed the extent to which an unmeasured confounder would need to be associated with both the exposure and the outcome to refute the observed association (VanderWeele and Ding 2017). To this end, the E-value, which is a continuous measure of robustness of the association to potential uncontrolled confounders, was used. Analysis was conducted using Stata 14.

Results

Influence of financial behaviour (saving and debt) on health and health behaviours

Results pertaining to interrelationship between financial decisions related to savings and debt and health and health behaviours are given in Table 3.

Table 3 Regression estimates and odds ratios for relationships between credit, savings and well-being—Social Diagnosis (2011, 2013 and 2015), Poland

Outcome	Credit (ref. = no credit) and savings (ref. no savings) in 2013			Sample size
	Has credit, but not over-indebted	Has credit and over-indebted	Has savings	
Physical health				
Satisfaction with health				
Estimate	− 0.056*	− 0.255**~	0.065*	8705
CI	(− 0.112, − 0.000)	(− 0.421, − 0.088)	(0.007, 0.123)	
Count of psychosomatic symptoms in the month preceding the survey				
Estimate	0.449***	0.723*	0.019	8726
CI	(0.232, 0.666)	(0.084, 1.362)	(− 0.216, 0.253)	
Not being worried about health conditions				
OR	0.866*	0.463***~	1.042	8722
CI	(0.759, 0.988)	(0.313, 0.685)	(0.910, 1.193)	
Sleeping well				
OR	0.915	0.583*~	1.04	8724
CI	(0.807, 1.039)	(0.383, 0.888)	(0.912, 1.184)	
Not feeling tired				
OR	0.865	0.753	0.966	8775
CI	(0.742, 1.008)	(0.493, 1.149)	(0.826, 1.131)	
Emotional health				
Happiness				
Estimate	− 0.034*	− 0.085	0.030*	8773
CI	(− 0.063, − 0.005)	(− 0.178, 0.009)	(0.002, 0.058)	
Life satisfaction				
Estimate	− 0.037	− 0.181*	0.084***	8689
CI	(− 0.089, 0.015)	(− 0.348, − 0.014)	(0.034, 0.135)	
Life perception				
Estimate	− 0.052*	− 0.09	0.078***	8768
CI	(− 0.099, − 0.004)	(− 0.252, 0.071)	(0.033, 0.124)	
The last year was a good one for you				
OR	0.914	0.586*	1.316***	8227
CI	(0.772, 1.081)	(0.355, 0.965)	(1.105, 1.568)	
Being full of energy				
OR	0.916	0.856	1.013	8773
CI	(0.800, 1.049)	(0.568, 1.292)	(0.885, 1.161)	
Having visited a psychologist or a psychiatrist in the last year				
OR	1.091	1.283	1.191	8761
CI	(0.821, 1.450)	(0.566, 2.908)	(0.871, 1.627)	
Having thoughts about suicide in the recent months due to feeling depressed				
OR	1.490*	2.385*	0.888	8752
CI	(1.027, 2.160)	(1.023, 5.561)	(0.585, 1.347)	
Willingness to live				
Estimate	− 0.052	− 0.199	0.062	8775

Table 3 (continued)

Outcome	Credit (ref. = no credit) and savings (ref. no savings) in 2013			Sample size
	Has credit, but not over-indebted	Has credit and over-indebted	Has savings	
CI	(− 0.141, 0.036)	(− 0.485, 0.087)	(− 0.026, 0.150)	
Feeling lonely				
OR	1.218*	1.627*	0.922	8641
CI	(1.040, 1.427)	(1.053, 2.514)	(0.780, 1.091)	
Health behaviours				
Smoking tobacco products every day				
OR	1.053	1.06	0.784*	8754
CI	(0.879, 1.260)	(0.613, 1.832)	(0.648, 0.948)	
Drinking too much alcohol in the last year				
OR	1.244	1.428	0.944	8773
CI	(0.947, 1.633)	(0.684, 2.979)	(0.701, 1.272)	
Practicing sport or other physical activity				
OR	1.006	1.039	1.250**	8608
CI	(0.874, 1.157)	(0.700, 1.542)	(1.077, 1.451)	

The analysis sample was restricted to those with valid data on credit and savings, well-being outcomes, health behaviour outcomes and all other covariates

All models in the table were adjusted for baseline demographics (sex, age, marital status, education level), baseline financial situation (labour market status, equivalized household income, satisfaction with income, experiencing financial problems), baseline social capital and civic engagement (generalized trust, satisfaction with relationships with friends and voting in the last parliamentary elections), baseline lifestyle factors (including frequency of watching TV, participation in the cultural and social life and satisfaction with leisure time) and baseline health conditions (having certificate of disability, being seriously ill in the last year, experiencing activity limitations owing to health problems). Additionally, each model is controlled for set of baseline outcomes investigated in other models

CI—95% confidence interval, OR—odds ratio

*$p < 0.05$; **$p < 0.01$; ***$p < 0.00294$ (0.05/17) with Bonferroni correction

~$p < 0.05$, test of equality of coefficients related to having credit but not being over-indebted versus having credit and being over-indebted

Impact of credit on self-rated health was clear. Respondents with credit but not over-indebted had a health assessment, lower by 0.056 on average on the 6-point scale, than those without any credit obligations. Over-indebtedness induced further deterioration in health status as recorded by SRH. This decline for over-indebtedness amounted to 0.255 points, compared to those without credit obligations. Savings, however, seemed to protect against negative effects on self-reported health. Respondents with savings declared self-reported health higher by 0.065 on the 6-point scale compared to those without savings. Findings also showed that not only was self-assessed health affected but credit and especially over-indebtedness influenced psychosomatic responses. The number of symptoms reported on PHQ-15 scale increased with credit commitment by 0.449 points. Impact from over-indebtedness was markedly higher, by 0.723 points, than for non-indebted individuals. No protective role of savings was observed for psychosomatic measures.

Debt and especially over-indebtedness induced worries about health. For individuals with debt but not the over-indebted, odds for not being worried were over 13% lower than for those without debts. For those over-indebted, odds were lower by almost 54%. A similarly strong negative effect of over-indebtedness was revealed for sleep difficulties. The odds for sleeping well were almost 42% lower for those who were over-indebted in comparison with those without credit. For both outcomes—being worried about health and favourable sleep patterns—no protective role of savings was observed. Although the probability of tiredness was in the expected relation to debt and savings, the confidence intervals were wide and included the null.

Emotional health, measured by the happiness indicator, suggested a positive protective role of savings and a negative role for credit. The reaction was, however, not major, as increase in happiness was only 0.03 on the 4-point scale for savers. A similar decrease in happiness was noted for indebted individuals. The association for over-indebtedness

Table 4 *E*-values for effect measures and for CI limits—Social Diagnosis (2011, 2013 and 2015), Poland

| | Credit (reference: no credit) | | | | Savings (ref. no savings) | |
| | Has credit but not over-indebted | | Has credit and over-indebted | | Has savings | |
	For effect estimate	For CI limit	For effect estimate	For CI limit	For effect estimate	For CI limit
Physical health						
Satisfaction with health	1.25	1	1.7	1	1.274	1.076
Count of psychosomatic symptoms in the month preceding the survey	1.412	1.269	1.576	1.149	1.065	1
Not being worried about health conditions	1.358	1.086	2.301	1.71	1.167	1
Sleeping well	1.263	1	1.947	1.316	1.161	1
Not feeling tired	1.359	1	1.572	1	1.15	1
Emotional health						
Happiness	1.306	1.097	1.572	1	1.285	1.059
Life satisfaction	1.219	1	1.625	1.125	1.367	1.207
Life perception	1.282	1.067	1.404	1	1.369	1.214
The last year was a good one for you	1.266	1	1.94	1.153	1.558	1.284
Being full of energy	1.26	1	1.376	1	1.088	1
Having visited a psychologist or a psychiatrist in the last year	1.406	1	1.885	1	1.667	1
Having thoughts about suicide in the recent months due to feeling depressed	2.344	1.194	4.202	1.175	1.504	1
Willingness to live	1.2	1	1.467	1	1.221	1
Feeling lonely	1.442	1.162	1.868	1.19	1.249	1
Health behaviours						
Smoking tobacco products every day	1.189	1	1.203	1	1.512	1.194
Drinking too much alcohol in the last year	1.794	1	2.209	1	1.311	1
Practicing sport or other physical activity	1.057	1	1.16	1	1.481	1.236

CI—95% confidence interval

was large, but the confidence interval contained 0. Life satisfaction was positively related to savings and influenced by over-indebtedness. Excessive debt seemed to be the source of considerable decrease in life satisfaction. Negative impact of over-indebtedness amounted to almost 0.2 points on the 6-point scale.

Savings and debts weighed heavily on the perception of life. Individuals reporting savings tended to perceive life better by 0.078 points on a 7-point scale. Those who had credit tended to evaluate their lives less favourably, reporting an average assessment 0.052 points lower. Rating the year as a good one was also very significantly affected by savings. Savers had 31.6% higher odds for this than those without savings. Those who had lapsed into over-indebtedness had 41.4% lower odds for a positive assessment of the previous year than those free of debt.

Although neither savings nor debt significantly influenced the probability of visiting a psychologist or psychiatrist or willingness to live, suicidal thoughts were strongly driven by credit—over-indebtedness in particular. Individuals with debt had 49% higher odds for suicidal thoughts, and these odds for the over-indebted were 139% higher than for individuals without credit.

Regarding health behaviour, savings limited probability of smoking cigarettes (21.6% lower odds—for savers) and increased probability of taking part in sport or other physical activity (25% higher odds—for savers). Indebtedness, however, seems to have little influence on health behaviour.

Sensitivity analysis for unmeasured confounding

The sensitivity analysis examined the robustness of results to potential unmeasured confounding. "*E*-values" (Table 4) represent the minimum strength of association, on the risk ratio scale, that an unmeasured confounder would need to have with both the exposure and the outcome, above and beyond the measured covariates, to fully explain away a specific exposure–outcome association (VanderWeele and Ding 2017).

E-values for effect estimates were between 1.057 and 4.202 for credit/savings indicators and ranged from 1.00 to 1.71 for confidence interval limits closest to null. This implies that not all associations between financial decisions regarding saving/debt and well-being outcomes could be considered robust to unmeasured confounding.

Among the physical health outcomes the PHQ-15 scale with respect to credit proved to be robust to the unmeasured confounding. To explain away the observed association between credit and the number of reported symptoms with PHQ-15 for those having regular debt and those who were over-indebted, only an unmeasured confounder that would be associated with credit and psychosomatic health symptoms by a risk ratio of 1.412-fold each (for regular debtors) and 1.576-fold each (for those who were over-indebted), above and beyond the measured confounders, could explain away the reported relationship. Weaker confounding could not. Even larger confounding would be required to explain the relationship between credit and not being worried about health conditions. Confounding effect of a magnitude 1.358-fold and 2.301-fold related to regular credit and over-indebtedness, respectively, would be required to explain the impact of debt on worries about health conditions. Over-indebtedness proved to be also robustly associated with sleeping problems. An unmeasured confounding associated with over-indebtedness and sleeping problems by 1.94-fold risk ratio would be required to explain away the relationship between the two variables.

Measures of emotional health also seemed robustly related to saving decisions. Life satisfaction, perception of life and assessment of the last year would require respective unmeasured confounding variables associated by risk ratio of 1.367, 1.369 and 1.558, to refute reported relationships between well-being and savings. Negative effect of over-indebtedness on assessment of the last year would require unmeasured confounding associated with both exposure and outcome of a 1.94-fold magnitude, in terms of risk ratios. Over-indebtedness affected suicidal thoughts significantly. To explain away the negative effect of over-indebtedness on suicidal thoughts, an unmeasured confounder associated with both exposure and outcome with a risk ratio of 4.202 would be required. Although confounding for effect of debt on emotional health was large, caution is required, since the lower limit of the 95% confidence interval for an unmeasured confounder relating to both exposure and outcome in terms of risk ratios was only 1.153 for satisfaction from the last year and 1.175 for suicidal thoughts.

Savings proved uniquely and robustly related to some health behaviours assessed. It was associated with less smoking and more sporting activity. A confounding factor associated with saving and cigarette smoking of magnitude 1.512-fold (expressed in risk ratios) would have been required to explain away their interrelationship. Likewise, a risk ratio of 1.236 for an unmeasured confounder would have been required to explain away a relationship between saving and sport activity.

Discussion

This study sought to reveal the causal effects of financial behaviours in terms of credit and savings on health and health behaviours. The results of our analysis indicated that debt, excessive debt in particular, was a significant stressor, with effects on both physical and emotional health. Saving played a less significant role in physical health, although it still had significant bearing on emotional health and proved significant in shaping positive health behaviours. Findings here did not reveal the link between debt and health behaviours reported by Drentea and Lavrakas (2000).

The study deepens our understanding of the health outcomes of Polish credit and savings holders. First, the study corroborates Drentea and Lavrakas' (2000) findings that debt is significantly associated with poorer physical and self-reported health. Owing to longitudinal data, with controls for baseline financial market behaviour, baseline level of outcome variable and baseline controls, together with measurement of exposure prior to the outcome, accounting was made for the temporal cause and effect sequence and addressing issues of reverse causality. This latter issue, described in the works of Grafova (2007) or Emami (2010), might surface in an interaction between health and financial behaviour since it is clear that better health is a likely stimulator for change in financial behaviour.

Second, as debts are a source of significant risk and distress (Brown et al. 2005; Sweet et al. 2013), it was found that Polish debtors seemed susceptible to suicidal thoughts. This applied especially to those with excessive debts. This confirms Wang et al. (2012) who found that financial problems led to more suicide attempts than most other psychological conditions, with the exception of depression. Despite the fact that in Poland in 2015, substantial group of mortgage holders suffered from a sharp increase in the

value of debt due to Swiss franc appreciation (Białowolski and Węziak-Białowolska 2017), part of the credit union segment of lending industry had to be bailed out and few illegal firms granting payday loans were temporarily operating and abusing their clients (Cwynar et al. 2017), no widespread effects on population of the factors related to external shocks or institutional organization of the financial market in Poland have ever been reported.

Findings from this study should also convey a message to policy makers, providing recommendations to foster saving activity, develop institutional solutions for heavy debt and create opportunities to develop positive health behaviours. Sherraden (1991), later continued by Curley et al. (2009), argued that acquisition and ownership of assets, in addition to savings, may improve economic, psychological and social well-being, especially for those who seem not to have adequate resources to save, i.e. the poor. There should be room in policy to improve the conditions for making the first step, because initial acquisition of assets constitutes a very strong effect on their future accumulation. Initiating asset accumulation shapes cognitive and emotional stances towards the future (Sherraden 1991; Curley et al. 2009) and discourages spending impulsivity, helping individuals to distinguish between their needs and wants (Scanlon and Adams 2008). These impacts on behaviour are in line with Becker and Mulligan's (1997) theory of endogenous time preferences. Cawley and Ruhm (2011) reported that individuals should be presented with incentives to reduce their rate of temporal discounting, as it likely induces saving and positively influences the value of lifetime utility. Those facing problem debts should be also provided with the institutional framework to overcome the issue. There are two likely culprits. First, Sweet et al. (2013) suggested that debtors likely forgo medical care in order to reduce the strain on family budget. Providing health care for those facing debt problems might be crucial for maintenance of their health. A second issue relates to the fact that people with debt might receive inadequate care, since health professionals may not adopt a holistic approach or do not include resolution to problem debt as part of the solution to health problems (Fitch et al. 2007). This might ultimately exacerbate problems. Promotion of positive health behaviours is strongly influenced by higher discount rates for health than for money, as reported by Lawless et al. (2013). Consequently, people devote less attention to their health status in order to preserve their financial status. This might frequently result in serious negative consequences and should be addressed by policy. One solution might be to stress the importance of healthy behaviour during the educational process. An alternative would be to increase interest rates on current savings for those who engage in healthy activities, linking discounting in the monetary and health domains more directly.[1] Our findings showed that when savings increase, which implies a reduction in discount rate for the future, they stimulate positive and discourage negative health behaviours.

Limitations

Despite the strengths, our study has also some limitations. First, regardless of using a broad list of controls, we were not able to use a full medical history to better control for the past health states. Second, we were not able to account for the information whether the health status affected directly financial position. Instead, we inferred about such a link from the data available.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Data availability The authors declare that the data used in the study are fully anonymized and originate from freely available source (www.diagnoza.com).

Informed consent All respondents gave the informed consent before the participation. Data were collected through self-reported questionnaires. This manuscript reflects original work.

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[1] Such products, although probably not sufficiently strengthening the link by economic incentive, are already present on the market. Allegacy Federal Credit Union offers all health account that links interest payments to physical activity of its members (https://www.allegacy.org/savings/allhealth-wellness-savings).

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